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AGRICULTURAL REGIONS OF AFRICA

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4. SORGHUM, MILLET, MAIZE, AND LIVESTOCK REGION

(*See* 9 on the map)

FROM the Coast just south of the mouth of the Congo River this area extends south and broadens to include the southern half of Angola, northeastern Southwest Africa, the southern part of Northern Rhodesia, the northern two-thirds of Bechuanaland, almost all of Southern Rhodesia, the Transvaal north of the high plateau, and extends south, east of the Drakensberg to include the area above the 1,000-foot contour in Natal and down to the Coast in eastern Cape Province. It also includes the central part of Portuguese East Africa and the western three-fourths of Madagascar. The elevations in this region are for the most part between 1,000 and 5,000 feet, although they reach sea level in the southeast, in western Madagascar, and in northwestern Angola. This is a very large area totaling about 1,300,000 square miles or over two-fifths the area of the United States.

This region could easily have been united with the Manioc, Millet, and Sorghum Region since the two are much alike. However, that region lies closer to the equator. The production of tropical crops is better in the manioc than in the sorghum belt. But sorghum is equally productive in the two regions, in fact, the greatest production of sorghum is in the belt south of the Sudan and north of the equator. In the sorghum region, however, elevations and distance from the equator shut out manioc and it seemed best to separate the regions on that basis. These two areas, generally ideal for warm-weather summer crops such as cotton, maize, sorghum, and millet, have a combined area of 2,944,000 square miles, or nearly that of the United States.

Natural vegetation.—The natural plant cover of this region is dry forest (Figure 107) and Acacia-tall grass savanna (Figure 113). These two types are similar in species and in the conditions of soil and climate indicated. Where trees stand close together they are usually not dense enough to shut out the grass cover. Over most of the area great stretches of tall grass are interrupted by single trees or groves of trees. The grasses are usually three to five feet tall and do not form a close sod. Trees are often thorny and flat-topped but

this is by no means a constant characteristic. During periods of drought, fires run through and burn off the grass without killing either the grasses or the trees. Before the rains begin, trees and perennial herbs often spring into flower ahead of the leaves which usually follow after the rains have begun. Growth following the rains is rapid and luxuriant.

Rainfall, temperature, and soils.—Rainfall is from about 20 to 35 inches during midsummer from November to March; the drought period of four to seven months comes in winter from April to October. Low temperatures vary from about the freezing point in the more tropical portions to as low as 10 degrees F. below freezing at higher elevations and higher latitudes. These low temperatures are not suitable for the growth of manioc. High temperatures are recorded in early summer before the beginning of the rains. The maximum may rise as high as 99 to 105 degrees F. The soils are largely of the chernozem group with some of the red loams in the warmer areas. As a rule, they are productive and for the most part are pedocals with lime accumulations in the subsoil.

Fauna.—The fauna of this region is extremely rich. This open savanna country is the home of elephant, rhinoceros, giraffe, eland, lion, leopard, cheetah, many cats, hyenas, jackals, African hunting dog, zebras, hippopotamus, warthog, bush pig, buffalo, hartebeest, wildebeest, duiker, waterbuck, lechwe, cob, reedbuck, red reebok, impala, as well as springbuck, roan antelope, sable antelope, bushbuck, nyala, sititunga, greater kudu, baboons, monkeys, and many game birds. Many parts of the area are good hunting grounds.

Peoples.—The native peoples of this area are chiefly Ovambo, Barotse, Matabele, Mashona, Bavenda, Bapedi, Swazi, Baila, Anyanja, Makua, and in Madagascar the Sakalava. They are Bantu peoples with the possible exception of the Sakalava and are for the most part agriculturists, although cattle are commonly kept in much of the area. The Sakalava are a cattle-raising people, probably of African origin.

Natural production.—The natural products of this region include meat and hides from the many wild animals. The drought period is utilized by natives as a time when grass fires can be used to aid hunters to secure meat.

Timber is not abundant but is very important. Most of the trees of the manioc region are also found here. Among the more important of these are Rhodesian teak, West African ebony, mulombiva, white thorn, knobby thorn, mopane, Rhodesian copaiba, musodo, muputu, and Rhodesian asp. The following varieties are also important in this region. Aligna (*Afzelia africana*) is a valuable mahogany-like wood, and the tree also furnishes in its attractive black seeds with a scarlet cup-shaped aril, a valuable marketable curiosity. Tallowwood, locally called Mpinji (*Ximenia americana*), is widely distributed and serves as a fruit and the seed produces an edible oil. Inchange (*Diospyres mespiliformis*) is a valuable wood and fruit tree. Munkonongo (*Garcinia livingstonei*) has an exceptionally palatable acid fruit and is now being grown in Florida. Another fruit which should be introduced into the United States and which grows wild in this area is the malulu (*Canthium lanciflorum*), prized by natives and whites alike.

Makusu or mahobohobo (*Uapaca sansibarica* and other species) produces an abundance of very sweet fruits with a flavor similar to bumblebee honey. The wood is also used for many purposes. Most of these trees are also abundant in the manioc region.

Among the fruit trees which grow wild in this region are morula, custard apples, rose apples, Kafir orange, tamarind, borassus, jujube, mango, cashew, and carissa. However, this is a very short and inadequate list of the native fruits of this region.

Rubber is produced chiefly by *Landolphia kirkii* which also produces an edible fruit.

The oil trees are mainly *Trichilia emetica*, *Ricinodendron africanum*, *Sclerocarya caffra* and *Ximenia americana*. Ricinus is practically a wild plant and *Telfaria pedata*, a large vine, produces an excellent edible oil seed.

Here also are many fiber plants. The bark of *Brachystegia* produces strong fiber, rope, and bark cloth and the baobab tree not only fiber and edible leaves but fruit from which a refreshing drink is made.

Native food crops.—In this belt, sorghums of many types are grown. In general they are of the South African Kafir corn group. As a rule, the deep red and dull brown types are used for making a native beer and the lighter red and white types are ground into flour and eaten as a mush.

Maize is probably next in importance as a native food (Figure 10), and the varieties are similar to the best American and South African strains such as Hickory King and Salisbury White. Maize is often interplanted with other crops, such as sorghum, or mixed with cucurbits, beans, groundnuts, or voandzeia. Any possible combination may be found, varying with the tribe, site, character of the soil, and natural plant cover. In Northern Rhodesia (Trapnell, C. G. and Clothier, J. N. The Soils, Vegetation and Agricultural Systems of Northwest Rhodesia. Report of the Ecological Survey. Lusaka 1937), the types of native agriculture have been studied in some detail. The northern part is included in the manioc region where manioc takes an important place as a native food. In this sorghum region, maize, pennisetum, and eleusine are of prime importance. Where the lands are poor, they are occupied by backward peoples who sow sorghum or eleusine on ash fertilized land. More often sorghum is planted with the hoe and interplanted with maize.

Pennisetum may be the staple mixed with sorghum, maize, and root crops. Generally the trees are cut and burned and the grain broadcast on the ashes or put in with the hoe. Often trees are felled over a larger area and carried in and burned to increase the amount of ash fertilizer. On these ash patches either eleusine or pennisetum is planted or in better areas, sorghum, maize, and pumpkin are planted with the hoe.

In general, pennisetum, eleusine, and sorghum, all of which are staple food crops, are also used for making native beer. Sorghum is of many varieties which vary in color and density of the fruiting head.

Groundnuts, sweet potato, voandzeia, coleus, cowpea, pigeon pea, many varieties of beans, cucumbers, melons, gourds, pumpkins, tomatoes, ochra, eggplant, sesame, chillies, and sweet sorghum are grown and a large variety of other crops such as ricinus and tobacco.

Crops may be divided into summer and winter crops, since in winter cool-weather crops thrive, while in summer warm-weather crops are favored. Any annual crop that can be grown in the tropics will do well in summer and almost any cool-weather crop can be grown here in winter.

The summer crops are sorghum, eleusine, pennisetum, maize, groundnuts, rice, sweet potatoes, sesame, tobacco, voandzeia, chillies, tomatoes, eggplant, and ochra. The winter crops are peas, beans, and potatoes. In fact, since

in general they do not irrigate their crops, the natives are limited mostly to the warm-weather crops which are grown during and following the rainy season.

Native livestock.—Over much of the area the tsetse fly limits cattle production. Scarcity of food during the long, dry winter period is often a limiting factor. Only the hardier African breeds can be kept, except in the south and at high elevation. The total number of cattle in the region can be roughly estimated at about 5,285,000 on the continent and 6,900,000 in Madagascar, or 12,185,000 for the whole region, which is about 9.7 cattle per square mile. Most of these are in Madagascar and Southern Rhodesia (Figure 34) and the low veldt of the Transvaal.

This is a great cattle belt but the hazards of cattle-rearing in a wild country are illustrated by the Southern Rhodesia report for 1928 which gives the four main causes of loss as follows: 1.5 per cent due to disease, 3.8 per cent to drought and old age, 1.1 per cent killed by wild animals, and 0.6 per cent lost or stolen, or a total annual loss of 7.0 per cent. Among natives a similar record reported by the native commissioner at Ntoko gives the annual casualty list for 34,500 cattle for 1926 as follows:

Killed for food	1,577
Killed for burial feasts	138
Killed to propitiate ancestral spirits	24
Killed by lions	33
Killed by leopards	39
Killed by wild dogs	18
Killed by snake bite	19
Died of natural causes	2,164
Sold for cash	615
Total	4,627 or 13.4 per cent

Had this report come from near a river or large body of water, crocodiles would have accounted for the loss of many cattle. Often drinking places are protected by piling. This is a common practice in the Upper Nile.

In this region, sheep (Figure 35) and goats are by no means as important as cattle. The goats are about twice as numerous as sheep. Together they total about 5,272,000 or about four per square mile. They are much more equally distributed on the continent than cattle but are not important in Madagascar. Together, cattle, goats, and sheep represent about 13,339,000 animal units or about 10.3 per square mile. There are probably 300,000 pigs in this area, practically all of which lies south or west of the line of Islamic influence. Horses do not exceed 61,000 for the whole area. Donkeys, more numerous than horses, total over 214,000 for the area. As everywhere, chickens are important and bees also contribute greatly to the animal production of the region.

European crops.—From a European point of view, this is largely a maize and cattle country. Cotton should ultimately be an important crop, but there is so much wild country (Figure 271) that the control of insect pests, especially jassids, aphids, and bollworms have proved almost too great a task. This does not mean, however, that ultimately this region will not be a great cotton-producing area.

Maize (Figure 225) occupies the greatest acreage, exceeding the total of all other crops. Much of the produce is used locally but it still ranks high as an export crop.

This region is fairly well typified by Southern Rhodesia. (Southern Rhodesia. Report on the summer crop returns for the season 1927–28 and the winter crop and livestock returns for 1928. Salisbury 1929.) Here crop production is divided into winter crops (cool-weather crops), grown chiefly from April to September, which is also the drought period of the year when irrigation is desirable and summer crops (warm-weather crops), grown from October to March, which is the rainy period.

FIGURE 271.—Typical view in Acacia-tall grass country, showing area cleared and planted to maize under European supervision. It was given up because of the ravages of baboons. A few small patches of sorghum and maize are maintained by natives. Kafue, Northern Rhodesia.

Winter crops occupy a relatively small acreage (about 7,300 acres in 1928) as compared with summer crops (about 389,000 in 1926–27). Of the winter crops, wheat leads in acreage (3,272 acres), followed by oats (1,979 acres), potatoes (978 acres), barley (950 acres), and onions (172 acres). Orchards are chiefly of citrus fruits of which oranges (Figure 21) lead, followed by lemons, tangerines, grapefruit, and limes. Deciduous fruits are chiefly peaches, apples, and plums and tropical fruits are chiefly papaya, mangoes, and avocados. In this region the winter period, which is dry, offers great opportunities for extension of production by means of irrigation.

Summer crops are maize (295,290 acres), sorghum, buckwheat, and pumpkins (1,614 acres), cattle melons (710 acres), potatoes (1,829 acres), sweet potatoes (651 acres), groundnuts (6,882 acres), beans (2,945 acres), velvet beans (2,628 acres), cowpeas (1,454 acres), maize for silage (11,447 acres), sunflower for silage (2,632 acres), teff, paspalum, and other grasses (1,595 acres), cotton (1,340 acres), and tobacco (46,622 acres). This will serve to show the variety of crops which can be grown and also that they are concerned largely with the production of feed for cattle.

Tobacco stands high as an export chiefly because of the high value of the manufactured product. Maize stands next as an export. It is far more important than would be indicated by the export value, since it furnishes food for both natives and Europeans, and for cattle.

Livestock.—Cattle (Figure 224) are produced by Europeans in the continental portion of this region and number about 2,172,000. This is less than the number produced by natives on the continental portion of this region. Efforts made to improve the cattle by introducing Shorthorn and Hereford stock have not been too successful and the Africander stock derived from *Bos indicus* is the most successful under the conditions of rather high temperatures which prevail during much of the year. Goats and sheep owned by Europeans are most abundant in Southwest Africa and the Transvaal and probably do not total more than 3,814,000. There appear to be about 56,000 horses, 114,000 donkeys, and 89,000 pigs owned by Europeans.

Crops for export.—Cattle are the most important product of this region. For their production, natural grazing lands are required and crops of maize, sunflower, pumpkin, stock melon, veldt hay, and winter crops of small grains and legumes, produced with irrigation, provide supplemental feed.

Maize (Figure 225) is the most important crop and is used locally for food for man and beast and is exported in larger quantity than any other farm crop. While cattle far exceed any other class of livestock, sheep, goats, pigs, and poultry can be produced. Slaughter cattle, hides, and butter lead as export products in Southern Rhodesia, followed by cattle, fresh eggs, pigs, sheep skins,

bacon and ham, and fresh meat. Of the vegetable exports, tobacco leads in value, followed by maize, citrus fruits, maize meal, wheat flour, groundnuts, potatoes, legumes, fresh vegetables, sorghum and buckwheat, sugar, onions, barley, and cotton. While this gives a fair idea of the production in Rhodesia, similar lands in the Transvaal and Natal are much more fully developed.

Amount of land under cultivation.—Records are incomplete but those that are available indicate that maize occupies by far the largest area, about 1,904,000 acres; cotton occupies 51,000 acres; and sorghum and millet combined, an equal area. The total estimated acreage under cultivation is about 8,100,000, or less than 1 per cent of the total area.

Crop potentialities.—This is a warm-weather cereal belt. It is ideal for sorghums of many varieties, pennisetums, and eleusines. It is a maize belt and that crop is now the most important. Cotton can be grown on practically the whole area if once the pests can be controlled. During the cool period of the year, small grains such as wheat, oats, barley, and rye, many of the legumes, and potatoes can be grown. Citrus and deciduous fruits do well and even the tropical fruits (Figure 190) can be grown in much of the area.

Cattle are admirably fitted into the crop-producing potentialities, and hides, meat, and milk production should become increasingly important. It should become a region productive of cattle, corn, cotton, and warm-weather cereals. Citrus and deciduous fruits may also become important.

5. CATTLE, SHEEP, AND GOAT REGION

(*See* 11 on the map)

This region extends south from Loanda in Angola in a narrow strip which broadens to include much of central and southeastern Southwest Africa, and southern Bechuanaland. From the Atlantic Ocean, north of the mouth of the Senegal River and south of Cape Mirik, another strip averaging about 150 miles but varying from 50 to 250 miles in width, runs east across Mauretania and French Sudan, including the country about the bend of the Niger River. It extends east across the Territory of the Niger, north of Lake Chad and across French Equatorial Africa, and the Anglo-Egyptian Sudan at and south of the confluence of the White Nile and the Blue Nile and on east to include much of Eritrea. Then it runs south just east of the Ethiopian highlands. Another broad belt extends from near the Gulf of Aden in British Somaliland south to include much of south and eastern Ethiopia and adjacent areas in Italian Somaliland. It also extends west across Lake Rudolph to the Anglo-Egyptian Sudan and to Uganda. It includes much of North Kenya and extends down the Rift Valley in Kenya and Tanganyika to within 100 miles of Lake Nyasa. Another belt leads south through central Kenya to beyond the Tanganyika boundary between Kilimandjaro and the Indian Ocean.

This area totals 1,444,000 square miles or equals nearly half the area of the United States.

Natural vegetation.—The plant cover is Acacia–desert grass savanna (Figure 116). The grass cover, sparse and short, dries in place after growth and retains some of its nutrient value through the long drought period. Fire is not a very important factor, due to the sparse

plant cover. The thorny trees and bushes sometimes resemble a young orchard by their regular spacing and are leafless throughout the long drought period.

Rainfall, temperature, and soils.—Rainfall is light, ranging from 10 to 20 inches and comes in midsummer, June to September in the north, and December to March in the south. Conditions of temperature range from 40 or 50 degrees F. to 110 or 120 degrees F. Freezing temperatures are encountered in the southwestern portion of the area.

The soils are chestnut soils, characterized usually by dry and unleached subsoils. They are relatively productive, especially if water is made available by flood-water or other irrigation. Very little of the land is used for crop production and its value lies chiefly in the forage crop produced under natural conditions.

Fauna.—No region in Africa has a richer or more interesting fauna. The carrying capacity of the land is low, but otherwise conditions are favorable for large herbivora and equally so for the dependent carnivora. In the north the gazelles are prominent and the springbuck is also found here in the south. The giraffe, eland, ostrich, rhinoceros, elephant, oryx, dik-dik, hartebeest, zebra, and wildebeest also thrive here. With these are found the lion, leopard, cheetah, jackal, hyena, and hunting dog. It is probable that the herds of big game move about a great deal, depending on surface water supply (Figure 170) and feed, and they also move to more desert and less desert lands when food and water are not available where they are. However, there is evidence that they are largely creatures of habit and that movements are likely to take place along previously established routes.

Peoples.—This region is occupied by peoples of very different types. In the south the Bushmen and Hottentots are partly in this region, the former as hunters and the latter as cattlemen. The Hereros and Bechuanas, cattle-raising Bantus, also live in this region. The Bambara, Hausa, Fulani, Buduma, Dinka, and Shilluk live in the north and the Galla, Somali, Rendili, and Turkana in the east. Except for trade and crops produced by flood-water irrigation, the people must live on livestock or the natural production of the area, which is principally gum from the leguminous trees and the returns from the big game animals, and from domestic livestock.

Natural production.—The scattered tree growth produces in the north and east the gums which are so important in the world markets. These come largely from various species of Acacia, and constitute one of the valuable export products of the region. The hashab gum of commerce comes largely from Kordofan from the tree *Acacia senegal*, and is known as gum arabic. Another gum of importance is tahl gum from *Acacia seyal*. These trees extend across most of the region north of the equator. Along the Nile River and its tributaries and farther west in this region, the doum palm (*Hyphaene thebaica*) is not only an emergency food but produces vegetable ivory used in button-making. Each cluster contains between 100 and 200 polished yellow-brown fruits about the size of an apple. They are used as food by elephants and other wild and domestic animals, and by man.

In the south, one of the most valuable plants is the Tsama melon (*Citrullus vulgaris*), a wild watermelon (Figure 238), produced in quantity on small, rapidly maturing vines. The melons remain for long periods after ripening without decaying, and provide a source of water in an otherwise poorly-watered country. The natives hide the fruits

FIGURE 272.—Although grazing is the chief use of the cattle, sheep, and goat area, sorghum is grown whenever possible and stored in granaries as a valuable food. Drying sorghum (*Mabele*), preparatory to storing it in granaries. Mochudi, Bechuanaland.

in the sand to protect them from animals and to keep them for emergency use. Wild and domestic animals, and the natives and Europeans, rely on them as a source of food and water during long drought periods. This melon is grown in North Africa and it can undoubtedly grow throughout the whole region. It has, by introduction, partially established itself in the deserts of Arizona.

Trees are not large, but many of them are valuable not only for firewood and mine props but yield good timber. Among the more prominent in South Africa are wild olive (*Oleo verrucosa*), camel's thorn (*Acacia giraffae*), karreeboom (*Rhus lancea*), knoppiesdoorn (*Acacia pallens*), aapiesdoorn (*Acacia burkei*), matumi (*Adina galpinii*), and mlombwa (*Pterocarpus angolensis*).

In North Africa, the principal trees are Acacia (*A. senegal*, *seyal*, *etbaica*, *mellifera*, *orfota*, *pennata*, *subalata*, and *tortilis*) and many species of Combretum and Ziziphus. Many of the trees produce gums, fruits, and fiber useful to man.

Grasses are chiefly species of *Digitaria*, *Aristida*, and *Eragrostis* which constitute probably the most valuable resource of the region since they furnish forage for wild and domestic animals. Many browse plants are found here and some of the wild animals live almost exclusively on browse. In North Africa, *Chrysopogons*, *Aristidas*, and *Tetrapogons* are important.

Livestock.—This is primarily a livestock region and the inhabitants are dependent on livestock for a living. There are about 4,795,000 cattle. The greatest numbers of these are in Ethiopia, Eritrea, Italian Somaliland, and Kenya. Southwest Africa, Anglo-Egyptian Sudan, French Equatorial Africa, French Sudan, Niger Colony, and Upper Volta seem to have about equal numbers of cattle. On this vast acreage the cattle average about 3.3 per square mile. The forage is sparse and unequally distributed throughout the year, but it is of good quality. In all probability, the animals are dependent on browse plants during much of the long drought period. Water supplies are very unequally distributed and much of the area is dependent on floodwater (Figure 170) for stock purposes.

Sheep and goats are much more abundant and number about 13,986,000. Here again Ethiopia leads in numbers, followed by Eritrea, French Sudan and Southwest Africa. Mauretania, Italian Somaliland, Niger Colony, Anglo-Egyptian Sudan, and Upper Volta have about equal numbers. This total averages about 9.7 per square mile for the whole area. Expressed in animal units, the density would be about 5.3 per square mile, for cattle, sheep, and goats combined.

Camels are relatively abundant, about 576,000 being recorded for this region in North Africa. They are mostly in Italian Somaliland, Anglo-Egyptian Sudan, and Eritrea. About 86,000 horses are found, chiefly in the Upper Volta, Territory of the Niger, French Sudan, French Equatorial Africa, and Southwest Africa. Mules and donkeys together amount to about 327,000 and

are mostly in Eritrea, Anglo-Egyptian Sudan, Niger Territory, Upper Volta, French Sudan, Mauretania, and Southwest Africa.

Crop production.—This region is decidedly semiarid, and a sustained crop production is impossible. However, in favorable sites where water collects after rains, crops can be grown and on favorable soils short-season crops can often be brought to maturity. Moreover, wherever water is available for irrigation this land is unusually productive. Probably a logical place to include lands under irrigation would be under the date palm region which includes Egypt and the oases. Still it is probably best to include here such small areas of irrigated lands as occur in this region since the adjacent grazing lands are far in excess of the irrigated lands and characterize the whole agricultural approach. Only a very rough estimate can be given of the crop production. Sorghums (Figure 272) and millets are the most important. These are well adapted to a dry and hot climate. About 400,000 acres were recorded from this region, chiefly in the Upper Volta and the Niger. This record is probably very inadequate for undoubtedly it is produced in small quantities all through the best lands south of the Sahara. Heavy rains cause depressions to be filled with flood water and sorghum is often planted at the edge of the subsiding water. The seeds are put into the ground as near the water's edge as possible and the planting may continue for some weeks (Figure 5). As a result the outer or earlier plantings ripen first and the inner plantings reach maturity much later.

Cotton, from the records, is next in acreage, the total being about 105,000 acres. It is largely irrigated but is occasionally grown as a dry land crop. In the latter case plants are small but yield well. It is most important in the Anglo-Egyptian Sudan, Italian Somaliland, and Eritrea. The small grains, barley and wheat, are next with about 85,000 acres, largely in Eritrea and the Anglo-Egyptian Sudan.

Maize, with an acreage of only about 43,000 acres, is chiefly in Italian Somaliland and Eritrea.

Crops for export.—Exports from this type of country are principally gums which are collected from Acacia trees of many species. Hides and skins are important throughout the whole region and meat, though locally of great importance, is exported chiefly from Southwest Africa and from the French and Italian colonies in the north. Cotton, where grown, is also exported.

The amount of land under cultivation can be roughly estimated as about 780,000 acres or 0.8 per cent of the area. Much of this is irrigated.

Potentialities.—This is a livestock area and is admirably adapted to the production of cattle, sheep, and goats. Horses, camels, mules, and donkeys are produced largely as transport animals. The area is semiarid and water supplies often very uncertain and inadequate (Figure 170). Moreover, over-grazing is likely to reduce production permanently and encourage the encroachment of desert conditions. The heavy use of the areas south of the Sahara is probably a contributing factor to the general belief that the Sahara is encroaching on the Sudan region. Management and control of use is imperative in such an area but it is probable that it cannot be undertaken successfully when one considers the history and character of the inhabitants of the region. Where this type of country lies adjacent to well-watered highlands as in Eritrea, Ethiopia, Italian Somaliland, and parts of Southwest Africa, it offers ideal land for the extension of irrigation and for

the production of crops throughout the year. For the area as a whole the water supply is very limited, but where irrigation water can be secured it increases greatly the value of the adjacent grazing lands.

6. GOAT, SHEEP, AND CATTLE REGION

(*See* 12 on the map)

This region forms a narrow belt from the mouth of the Coanza River in Angola south along the Atlantic coast and inland in southern Angola. It extends from north to south across Southwest Africa as an interrupted belt at times more than 100 miles wide. In the Union of South Africa it includes much of the Karroid plateau and the Great Karroo. The coast strip in southwest Madagascar is placed in this region. From the mouth of the Tana River it extends west about 140 miles and then north to the Lorian swamp region, and east across Italian Somaliland and on north in a belt about 100 to 175 miles wide to the Gulf of Aden. In the north it broadens to include the eastern part of British Somaliland. The area then extends west along the coast of British Somaliland in a narrow belt and includes all of French Somaliland and most of the adjacent eastern Ethiopian lowlands. Southeastern Eritrea is included and a narrow strip of coast in northeastern Eritrea. It includes most of the highlands of eastern Anglo-Egyptian Sudan and the adjacent highlands in Egypt. It extends across the Nile at the mouth of the Albara and swings southwest at Khartoum. It extends west in a strip about 100 miles wide across the Anglo-Egyptian Sudan to French Equatorial Africa where it broadens to include Borku and Tibesti. Continuing west, it broadens to include Asben and farther west, northeast of the bend of the Niger to include Ifoghas Adrar, thus crossing French Equatorial Africa, the Niger Colony, French Sudan, and Mauretania where it turns north and reaches the Atlantic coast at Cape Mirik. It extends north in a coastal belt about 100 miles wide across Rio de Oro and into south Morocco. In Morocco there is a strip south of the mountains which extends from about the center of Morocco east and north until at the Algerian border it is about 125 miles wide and extends northeast in Algeria across the Plateau of the Shotts to east of the Shott of Hodna. It extends across south of the mountains into Tunis where it occupies most of the area between the Shott el Jerid and the mountains lying north. From here a coastal belt leads south and east to Tripolitania and is then reduced to a narrow strip which extends east, broadening in Cyrenaica where it passes inland reaching the coast again at the Gulf of Boma and then extends in a narrow strip to the mouth of the Nile.

A large area of highland in central and southern Algeria, including Ahaggar, is placed in this region. This area totals about 1,250,000 square miles.

Natural vegetation.—The vegetation of this area varies from a fairly good cover of desert grasses, which are usually scattered leaving much of the soil surface bare (Figure 273), to a similar stand of scattered desert shrubs (Figure 274) which may at times have little or no grass between them or may be scattered through the grass cover. Often there are small desert trees usually widely spaced. It is desert shrub-desert grassland and varies from desert grass savanna to desert shrub. It

produces more forage than the desert shrub. *Aristidas* are by far the most important grasses of this area in the south with a few species of *Digitaria* and *Eragrostis*. In north Africa the halfa (*Stipa tenacissima*) occupies large areas and *Aristidas*, *Cymbopogons*, and *Paniciums* are important. The desert shrubs are as important as the grasses for many of them are eaten by wild and domestic animals. In north Africa, Artemisia herba-alba and many other shrubs, and in the south the karroo bushes (*Pentzia globosa* and *P. virgata*) and many shrubs and fleshy plants furnish food not only in their leaves but the stem growth is also valuable forage long after the leaves have fallen.

Rainfall, Temperature, and Soils.—Rainfall varies from 5 to 15 inches and generally falls at very irregular intervals. In the Mediterranean region it is rather equally distributed through the year. This, however, is not true south of the Sahara, for at Timbuctu and Italian Somaliland it falls in midsummer, mostly in July and August, and south of the equator in midsummer from December to February, and often in violent storms. The drought period is from five to eight months and may even extend unbroken for over a year.

FIGURE 273.—The better parts of the desert have desert grasses with the desert shrubs, and often after rains a natural crop of annuals is produced. Groveport, Cape Province.

Temperatures range from about 19 to 122 degrees F, the low temperatures, especially in the north and at the higher elevation farther south, coming during the drought period.

The soils are light desert soils, varying in color from grey to browns or reds, depending largely on the parent material, and as a rule calcareous to the very surface. Where sandy, they absorb water more readily and produce more forage than where there are heavier loams or clays.

Fauna.—Under natural conditions this area is occupied by nearly all of the animals characteristic of the cattle, sheep, and goat region. The more characteristic are the oryxes (gemsbok, tufted beisa, beisa, and lewcoryx), the addax, somali and Nubian wild asses, many dik-diks and gazelles including the springbok, and the Nubian ibex; also lion, cheetah, leopard, many cats, hunting dog, jackal, elephant, giraffe, black rhinoceros, grevy zebra, warthog, ostrich, Hunter's and tiang antelopes and many other large animals. Naturally these animals move about and often into the adjacent regions. Wildlife resources have contributed materially to many of the native races by providing skins and meat.

Peoples.—The inhabitants of this region are largely cattle-raisers except in southwest Africa and in Eritrea where irrigation has been developed by Europeans. The native herders are chiefly Herero, Hottentots (Figure 243),

Somali Rendili, Danakil, Tuareg, Kabyles, Moors, and the northern Sudanese and Nilotic Negroes.

Natural products.—In the north, halfa or esparto (*Stipa tenacissima*) is harvested over large areas and used not only as forage but is gathered and used for matting, sandals, rope, hats, baskets, and other purposes. One of the principal uses is for paper pulp from which exceptionally fine paper for engravings and cigarette wrappers is made.

The greatest value of the shrub and grass cover is its use as forage for domestic and wild animals.

Livestock.—Goats and sheep are the most important of the domestic animals of this region. It is probable that they number about 17,803,000. Goats (Figure 218) probably slightly exceed sheep in numbers. The greatest numbers are in Cape Province, Algeria, and Morocco and smaller numbers in the French Sudan, Tunis, Italian Somaliland, Southwest Africa, and Mauretania. The total amounts to about 14 per square mile for the whole area.

Cattle are next in numbers and are very important; they aggregate about 2,735,000. Italian Somaliland and Morocco lead in numbers, followed by Algeria and Cape Province. They are distributed throughout the whole area. The density averages 2.7 per square mile. The density in animal units, if cattle, sheep and goats are combined, amounts to 5 per square mile.

Donkeys and mules total about 762,000. They are most numerous in Morocco, Algiers, Cape Province, and Tunis, and are found in most of the area.

Camels are important and more abundant than in any other region. They number about 728,000. They are most important in Italian Somaliland and Anglo-Egyptian Sudan, and less abundant in Morocco, Algeria, and Tunis, but are found throughout the area in North Africa.

Horses probably number about 233,000, and are most numerous in Morocco, Algeria, Tunis, and Cape Province, and less numerous in French Equatorial Africa, French Sudan, and the Niger Colony. They are found in all parts of the region. The ostrich was a native bird in this region and even now is important in the south.

Exports.—The only exports from this region are cattle, sheep, and goats and other animals, skins, hides, ghee, wool, and meats. Esparto is an important export from this region in the north and a small amount of cotton grown under irrigation is exported.

Very little land is under cultivation, probably amounting to not over 300,000 acres of irrigated land. Most of this is in the Cape Province and in Eritrea and a small amount in Southwest Africa.

Potentialities.—Where water is available this land can be converted into valuable irrigated land. Under natural conditions it is an excellent livestock area of low-carrying capacity. Goats, sheep, cattle, camels, horses, mules, donkeys, and ostrich can be supported on the natural plant cover.

7. GOAT, CAMEL, AND HORSE REGION

(*See* 13 on the map)

This region is not represented in South Africa although a small area adjacent to the Namib in Southwest Africa is similar physically.

In North Africa it includes the Nubian Desert and almost all of the land east of the Nile Valley in Egypt. West of the Nile it includes much of the Libyan

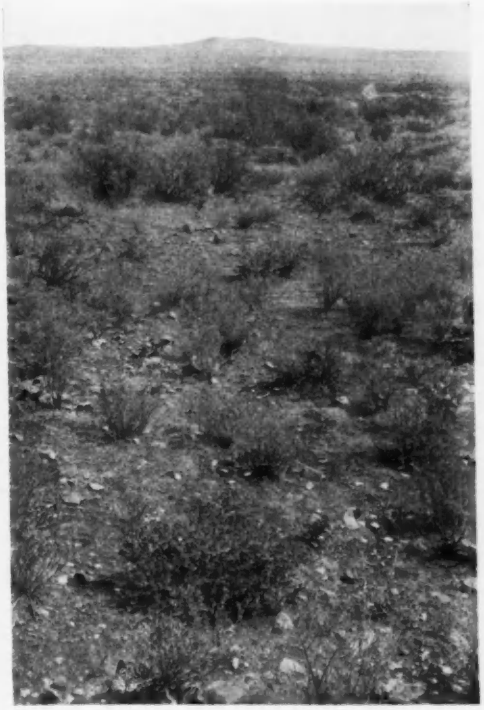

FIGURE 274.—The desert shrub is often valuable grazing land, especially when containing such edible browse as the karroo bush (*Pentzia*). West of Groveport, Cape Province.

Desert, a large part of Cyrenaica, Tripolitania, Algeria, and the northern part of French Equatorial Africa, the Territory of the Niger, French Sudan, and Mauretania. The total area is about 1,672,000 square miles.

Natural vegetation.—Most of this area is sparsely covered with vegetation. Desert shrubs scattered rather evenly (Figure 275), indicate by their density and size the amount of moist soil from which they are able to draw their water supply. Much of the soil surface is bare. The small shrubs sometimes present the appearance of a miniature forest of scattered trees. The plants furnish browse for wild animals and for domestic livestock.

Rainfall, temperature, and soils.—Rainfall is low, varying from three to ten inches and very unequally distributed. Drought may last from five months to a year or more. When rain falls it is often followed by an ephemeral growth of annuals, such as mustards and plantains, which are very important as forage. The perennials remain in a drought rest condition except where water is available. These local rains are followed by nomadic stockmen since they offer lush food of ephemeral drought-escaping plants called "Ashab" especially desirable under desert conditions. The shrubs are browsed when growing and also when in a drought rest condition. Rainfall is often torrential and flood damage at such times is severe. Naturally, in a region such as this the wadis or drainage channels are the most productive of plant cover and forage. They are somewhat intermediate between the desert and the oasis since here at least a temporary supply of water is available; water which has fallen over a much greater soil surface and is collected here.

Temperatures vary from about 22 to 125 degrees F. Occasionally higher temperatures are recorded. The world record maximum temperature, 136 degrees F., was recorded at Azizia about fifty miles south of Tripoli in Tripolitania on September 13, 1922. Only along the northern part of this region and at higher elevations farther south are freezing temperatures recorded.

The soils are largely materials left in place or moved by flood waters or wind and not yet subjected to sufficient leaching to form a profile. Lime is usually present to the very surface. Many areas are marked by desert pave, others are sandy and still others almost bare rock. Color is largely determined by the parent materials which are only slightly modified. The sands vary from nearly white to gold. In general, they are grey desert soils.

Animal life.—The sparse vegetation

supports a sparse animal population. Probably the most noteworthy animal is the addax, an oryx-like antelope which occupies some of the most barren parts of this region. It is specially adapted to a life in this desert region, is very light in color and fleet of foot and can go for a long period without water. The white oryx, slightly larger, is also characteristic of this desert region. Several species of gazelles, small, graceful, sand-colored antelopes are found. The Nubian ibex should also be listed here. Hares and other small forms as well as jackals are found especially along the wadis.

Peoples.—The peoples of this region, west of the Nile, are chiefly the Tuareg in the west, the Tebu in the east, and the Nubians mostly east of the Nile. Within this desert shrub area there are drainage courses where grasses thrive and where gum trees grow, and it is on such areas and the actual oasis that the herders rely for some of the food for their herds.

Livestock.—Livestock is the only product of this desert shrub area. It would be impossible to do more than give a rough estimate of the amount of livestock dependent on this region. The estimate is based on the relative amount of land of various types in each country and an estimate of the number of animals usually kept on each type. It is probable that there are about 5,100,000 goats and sheep, most of them being in Morocco, Algeria, Tunis, and the French Sudan. They are less abundant in the Anglo-Egyptian Sudan, Territory of the Niger, and Mauretania, but are distributed throughout the entire region. On the basis of the whole area there are about 4.8 per square mile.

Cattle probably number about 879,000, being most numerous in Morocco, Algeria, the Anglo-Egyptian Sudan, French Equatorial Africa, French Sudan, and Territory of the Niger.

FIGURE 275.—A sandy desert with a few dying doum palms in the back. The fruits are valuable for food and vegetable ivory. Scattered plants of *Calatropis procera*, one of the milkweeds, and probably valuable as a fiber, rubber, and medicinal plant. Atbara, Anglo-Egyptian Sudan.

Donkeys and mules number about 588,000, being most numerous in Morocco, Algeria, Tunis, Territory of the Niger, and the Anglo-Egyptian Sudan.

There are about 394,000 camels, chiefly in the Anglo-Egyptian Sudan (Figure 66), Tunis, Morocco, and Algeria, but they are found throughout the region.

Horses number about 186,000 and are most numerous in Morocco, Algeria, and Tunis, but are well distributed in the region.

The combined number of domestic animals would amount to less than 2 animal units per square mile for the whole area.

Potentialities.—This region must rely largely on livestock. Even here the returns will be low. But the area is large and combined with its proximity to the oases and the desert grasslands, it may play an important part in providing skins, hides, wool, meat, and ghee, so important as articles of commerce.

8. DESERT

(*See* 14 on the map)

True desert where no plants are produced is probably never found, but large areas in Africa approximate this condition so closely and the plants are evident, if at all, over such short periods of time that this area may be classified as true drought desert. The southwest coast from north of the Cunene River in Angola on south to below the mouth of the Orange River in Cape Province is a drought desert with annual rainfall as low as one inch per year.

In North Africa, great sand areas known as ergs, which are live dunes and practically destitute of vegetation, lie in the Sahara. These are mostly in Mauretania, Algeria, Tripolitania, Cyrenaica, Egypt, Anglo-Egyptian Sudan, French Equatorial Africa, Territory of the Niger, and French Sudan.

Besides these great areas of sand which may vary from almost white to almost the color of gold, there may be large areas of ripple sand (Figure 276), which are usually lighter in color than the dunes. Where the soil material has been a mixture of pebbles and fine material, continual wind removal of the finer particles leaves behind a perfect pave of pebbles, desert-varnished a deep red or black to form the desert pave or erg (Figure 121), which characterizes great areas in the Sahara and other deserts. Where all loose material is blown away, leaving only the bare rock, often fantastically carved by wind action, the surface is varnished by the oxidation of materials brought to the surface and is usually hard and dark red or black in color. This type of country is known as the hammada. From the point of view of the traveler, areas where no water is available for long distances, irrespective of the type of soil or rock surface are dangerous to caravans and have been referred to as tanezrouft (Gautier, E. F., Sahara. N. Y. 1935).

Natural Vegetation.—The vegetation of this extreme desert area is of two types of plants: drought-escaping and drought-enduring. The former are short-lived annuals which germinate quickly as soon as the soil is moistened by rain. They require only about six weeks to reach maturity and if soil drought occurs before that time they can curtail growth and mature a few seeds. These seeds may lie in the ground or be blown about for years before conditions are again favorable for germination. Growing in a drought desert region, they escape drought by limiting their growth to a short period following a rain. These seeds are sometimes carried to the lee side of a live dune where they are covered with sand and if rain comes, find unusually favorable moisture conditions for seed production. As in the American deserts, many of these drought-escaping plants are mustards and plantains.

The drought-enduring plants are slow-growing perennials which pass much of of the time in a drought rest condition, as do the seeds of the drought-escaping annuals. When water is again available, a few stems and leaves are produced and growth continued until drought forces another rest period. Many of these plants are of unusual appearance and are resistant to wind damage. One of the most outstanding plants of the Namib is *Welwitschia mirabilis*, related to Ephedra but with only two, broad, hard, tough, fibrous leaves, a yard or more long which lie on the surface of the ground on opposite sides of the nearly submerged stem. Another plant of sandy soils in the Namib is *Acanthosicyos horrida*, a spiny, bushy cucurbit. Its fruit is a valuable source of food and

water. In the Sahara the lichen *Lecanora esculenta*, the rock-like *Anabasis aretioides*, and on sandy soil *Ephedra alata*, *Genista raetam*, and *Aristida pungens* are all truly drought-enduring species. The traveler, guided by a small twig, can often dig up enough of the woody underground root system to build a fire.

In the minds of the public, excessive heat and sand storms characterize the area. However, there are many days, and much of the year, when atmospheric conditions are unusually pleasant and the air is dry and invigorating. Shade by vegetation is absent and there is little evaporation to cool the air. Wind is an important feature of the desert, and has greatly influenced the thinking of desert peoples who often attribute whirlwinds to the influence of spirits as do the American Indians of the Southwest. The "Harmattan" in the southwestern Sahara blows southeast and carries dust over the Sudan to the Gulf of Guinea. In the central Sahara the "Shahali" and in Algeria the "Sirocco" is the wind from the south. In Egypt the "Khamsin" is the desert wind "of fifty consecutive days" (Gautier, E. F., Sahara. N. Y. 1935).

Temperatures range from 25 to 133 degrees F. in In Salah and from 36 to 120 degrees F. in Aswan. Surface soils become so hot that they cannot be touched by hand or foot and men and animals cannot withstand the heat unless insulation or shelter is provided. Radiation of heat is rapid and nights may be uncomfortably cold even in summer.

Rainfall.—Rainfall over much of the area would probably range from three to five inches and may be characterized as rare, localized, irregular, and violent. In many parts of the desert it is much less, as is shown by the mean annual record of 0.12 at In Salah, of 1.69 at El Golea, of 0.60 at Swakopmund and of 2.46 at Port Nolloth. Even with low rainfall the rains are torrential and cause floods which do unusual damage in the dry soils. Great quantities of soil are also moved by wind action.

FIGURE 276.—Sand desert, destitute of any plant cover but probably containing seeds of drought-escaping annuals which will germinate and produce a new seed crop in a few weeks after a rain. Station Number 2, southeast of Halfa, Anglo-Egyptian Sudan.

Animals and man pass over these areas but do not derive their sustenance from them. Where these areas lie near wadis with forage or near oases where water and food can be secured, they are not difficult to cross. Where they extend for great distances without water or forage, it is hazardous to attempt to cross them. Large areas of this type known as tanzerouft have been avoided in planning the caravan routes.

Very rough estimates of the area of the ergs would be about 773,000 square

miles. Many of the areas of erg and hammada are more complete deserts than the ergs. Therefore, large areas listed in the goat, camel, and horse region should probably be included as desert.

This region has no value as agricultural land. Probably it is "irreclaimable for all time; never to be converted into arable land . . . the despair of the politician, the delight of any dreamer . . . ." Norman Douglas.

9. LIVESTOCK, COOL-WEATHER CROPS, AND TIMBER REGION

(*See* 5 on the map)

This type is limited to areas of high elevation in tropical Africa. Beginning in the north this region includes the highlands of Ethiopia, and broken by the Rift Valley it extends east into British Somaliland and south, east of the Rift Valley to Kenya. In Kenya it includes the highlands east and west of the Rift Valley and the isolated highlands about Mt. Kenya. It also includes parts of eastern Uganda and extends south across the Kenya-Tanganyika border.

Another great block occupies southern Uganda, Urundi and Ruanda, northwest and western Tanganyika, the eastern Belgian Congo, and extends across the highlands of the southern Congo into Northern Rhodesia in isolated areas. It occupies the area west and northeast of Lake Nyasa and extends across the highlands northeast of Lake Nyasa in Tanganyika territory. It is also found in southern Nyasaland and in adjacent portions of Portuguese East Africa. Isolated areas occur in the high mountains in eastern Madagascar, in the high country of western Angola, in the Cameroons and in the Fouta Djallon in French Guinea. It totals about 412,000 square miles.

Natural vegetation.—These highlands were probably forested under natural conditions. Now, however, a large portion of the area is a grassland. The temperate rain forest (Figure 105), found in the tropics at high elevation, extends north and south of the equator at succeeding lower elevations until it reaches the sea at the southern extremity of the continent. In the north it would pass imperceptibly into the deciduous and coniferous forests of the temperate zone if not interrupted by desert areas.

The forest is luxuriant with a very dense forest floor and masses of ferns, mosses, and vines, and many tall, smooth-barked trees of varying height. This forest, cleared and repeatedly burned to produce agricultural land, has given way to mountain grassland. The pure grassland (Figure 177) is green throughout practically the whole year, there being no drought or cold rest period. The grasses are two to three feet high and form a relatively dense cover (Figure 118). They are largely of the andropogon group. It is excellent all-year grazing land for cattle, horses, sheep, and goats.

Rainfall and temperature.—Rainfall varies greatly with slope and elevation but is generally from 40 to 60 inches. Temperatures are never high, seldom rising to 90 degrees F. and in the more central region they rarely fall below 65 degrees F. or rise above 85 degrees F. (Figure 277). However, the range is almost to the freezing point at very high elevations and farther from the equator. It is therefore ideal for cool-weather crops and tropical species are not killed out by frost or lower temperatures.

Although drought is not noticeable

in much of the area the fact that the Wachagga have developed an elaborate irrigation system would indicate that at times additional water could be used to advantage. However, there are no droughts which affect continuous production. Almost any crop which can be grown outside of the hot and damp tropical regions will do well here, but it is too cool for crops such as oil palm, cacao, and para rubber.

Soils.—These soils are red loams showing almost no evident profile in section. They are productive if judged by the crops which are produced on them. The high rainfall leaches these soils rapidly but many of them are on rather steep slopes, and are still young.

Fauna.—These areas are unusually productive of a dense plant cover and in turn a rich fauna. In many places, however, the dense population of natives almost excludes a heavy population of wild animals.

Among the more notable animals is the elephant which is often abundant up to the timberline on the mountains. The giant forest hog also inhabits the bamboo areas at high elevation. It is a large animal, four and a half feet tall and six feet long. There are also bongo, oribi, several duikers, nyala, decula antelope, buffalo, zebra, black rhinoceros, Jackson's hartebeest, white-bearded gnu, leopard, lion, colobus, chimpanzee, gorilla, and a large variety of smaller animals, birds, and tree-dwellers.

Peoples.—The inhabitants are Tigre, Amhara (Figure 250), Akikuyu (Figures 245 and 246), Wachagga, Bahima, Barundi, Watusi (Figure 249), Wanyiki, Wemba, Tumbuka, Angoni in the east, and in the west the Ovambo, Albo, and Landouman. In the east, the cattle-raisers are the overlords of Hamitic stock and the crop-raisers of Bantu stock are subservient to the cattle-raisers. Here such tribes as the Watusi in Urundi and Ruanda, the Bahima of Ankoli in Uganda, the Masai in Kenya and Tanganyika, the Angoni in Nyasaland and Northern Rhodesia are aristocratic cattle-raisers who hold in submission the agricultural Bantu peoples. Wherever cattle can be reared they are kept in large numbers and receive the major attention. In some of these areas they constitute almost the only source of food, for they are milked and bled regularly and the blood and milk constitute almost the exclusive diet of Watusi, Masai, and Bahima peoples. It is possible to keep cattle only where the temperate forest has been reduced to a grassland.

FIGURE 277.—In the high country the pericarp oil of the oil palm is sold as a solid when protected from the direct rays of the sun. N'gano N'gano, Urundi.

Natural products.—Under natural conditions this area produces timber and fruits from the forest and forage in abundance on the grasslands. The returns from ivory have ranked high in early times and it is still one of the export products of this region.

The forests are relatively inaccessible but many timber trees of value are found here. Among the important timber trees are the yellow woods which are conifers belonging to the genus *Podocarpus*. East African yellow-wood or Podo (*Podocarpus gracilior*) is a tall,

straight tree growing to a height of 100 feet. The wood is light, and harder and stronger than Scotch pine. Another species (*P. milanjianus*) having the same common name is slightly darker but equally useful as a timber tree. The yellow-woods take the place of pine in all kinds of construction work. A very unusual tree from the botanical point of view, is the muhuhu (*Brachylaena hutchinsii*), a large tree used in general construction work and belonging to the compositae. It forms large forest stands in the Kenya highlands. African camphor (*Ocotea usambarensis*) is a huge tree producing a teak-like timber. One of the outstanding trees is the largest of the junipers (*Juniperus procera*), sometimes six feet in diameter and 130 feet high. It is known in Africa as pencil cedar, has a red wood which takes a good polish, is termite-proof and durable. It has been exported chiefly for pencil wood.

There are two African olives (*Olea chrysophylla* and *O. laurifolia*) which produce hard heavy timber, taking a high polish and suitable for cabinet wood. One of the valuable trees of this region is Nyasaland khaya (*Khaya nyasica*), producing a mahogany-like wood extensively used as a cabinet wood. This tree now grows in Florida where it is said to be one of the most promising of the introduced timbers. Ficalhoa laurifolia is a large tree which produces a grey-brown or chocolate wood suitable for cabinet wood and construction purposes. Red stinkwood (*Pygeum africanum*) is valuable where a strong, tough wood is required for the construction of wagons and heavy furniture. In the south this forest passes into the subtropical fruit region, the forest trees are much the same, but the higher latitudes shut out coffee, banana, and similar crops which cannot withstand frost. Wild coffee is grown, several species being native to the region. The principal coffee, Arabian coffee (*Coffea arabica*), originated in Kaffa, Ethiopia, where it still grows as a wild plant. Bananas are also native to this region and one of these (*Musa ensete*) has a stem which is used for both fiber and food in Ethiopia. One of the important plants, the wild date palm (*Phoenix reclinata*), is thought by some to be one of the ancestors of the date palm.

The grasslands are natural forage areas, which support not only many native animals but also the domestic animals upon which the people of this region rely so heavily for a living.

Native agriculture.—Here would first be placed milk and blood from cattle which constitutes almost the sole diet of such peoples as the Masai, Watusi, Ankoli, Banyoro, and Wahima. At the time of Rindepest, according to Roscoe (John Roscoe. The Banyankola. University Press. Cambridge, 1923), whole families of Ankoli committed suicide rather than eat vegetable food. These cattle-raising Hamitic peoples depend almost entirely on cattle. The Ankoli keep herds of approximately 100 cows and calves to one bull and are very particular in the care of the herd to prevent inbreeding. They kill only calves and bulls. The Masai keep huge herds and are entirely dependent on them for food. The Watusi have large herds of the large-horned *Bos indicus* type (Figures 64 and 228) and depend entirely on these herds for milk, blood, and meat. They formerly ate the hides but this has been stopped by Belgian decree in order to increase the exports. This great cattle-raising aristocracy of east Africa occupies most of the grasslands. The less warlike tribes are driven into the forested hills or are kept not as slaves but as serfs. They do the ordinary labor and cultivate the soil. Only a few of the small hunting tribes

live naturally in the forests of the region.

The forest is cleared by cutting and later the trees are burned to produce agricultural land. Since south of Ethiopia the plow is not used, the slope of the land or the size or shape of the plantings is unimportant. Land is relatively rich and productive. Almost anything can be grown (Figure 278).

This is probably the most productive banana belt of all Africa. Here native species grow, and here is grown Musa ensete, the fruit of which is dry but the stem is used for food and for fiber. Still, the true banana is probably more characteristic here (Figure 57) than anywhere except in portions of Uganda where it is nearly the exclusive diet of the Baganda. Usually it occupies the ridges and slopes, while rice and sugar cane are planted on the alluvial bottomlands. Many varieties are grown of both the banana and plantain types. Banana is sometimes steamed before it is ripe and eaten as is sweet potato, or allowed to ripen and eaten as a fruit. More often, however, it is artificially ripened in a pit, the juice squeezed from the pulp and either consumed as a sweet drink or mixed with flour from dried germinated grains of sorghum or millet and fermented into a native beer. The banana furnishes most of the wrapping material used in this region.

Yams (*Dioscorea*) are locally very important (Figure 231). They produce large starchy roots similar to those of sweet potato but the vines grow up over bushes and small trees. Sweet potatoes (*Ipomoea batatas*) are grown almost everywhere. Not only are the roots dug whenever desired but the vines are pulled and fed to goats and sheep as forage. In many places the Irish potato (*Solanum tuberosum*) is also grown, for in this cool climate they do exceptionally well, but being a crop of recent introduction they are by no means as generally grown as are yams and sweet potatoes. In the warmer portions of this area grain sorghum is extensively produced, the deeper brown or red varieties are used largely to manufacture native beer and the light-colored varieties for food. In Urundi the sowing of sorghum is accompanied by one of the chief festivals of the year.

Eleusine is probably even more important than sorghum. It is a short-season crop and usually used as food. In fact, in certain sections a man does not say he has eaten unless he has had eleusine porridge, so dependent has he become on this single crop.

Pennisetum is also extensively grown and serves almost the same purpose as eleusine.

Maize is a major crop everywhere and is prominent in every market. It is eaten raw, boiled or roasted on the cob, or shelled and ground and made into a thick mush. Beans are especially important and many varieties are grown. In Urundi they constitute an important food and export crop. Cowpea is also extensively grown, the pods boiled before the seeds are hard and the seeds eaten from the pod. Pigeon pea is also an important crop as are other peas of

FIGURE 278.—The luxuriance of the temperate highlands is shown in the markets where bananas, sugar cane, maize, eggplant, peppers, beans, manioc, cowpea, sweet potatoes, yams, oranges, limes, tobacco, snuff, and eggs are sold. Moshi, Tanganyika Territory.

various sorts. Peanuts are not as prominent here as at lower elevations but are grown and used along with the other leguminous crops, and the native voandzeia is also grown and eaten as a boiled vegetable. Rice is extensively grown, most often in mixed cultures (Figure 176). It does not rank high in acreage as compared with other grain crops but is important locally. The cucurbits are important, especially squash, pumpkin, cucumbers, luffa, and melons. They form a part of almost every garden. Tomatoes, Coleus tuberosus, eggplant, peppers, and along waterways Colocasia, are all important. A typical native garden shown in Figure 176 at Moshi, Tanganyika Territory, shows a field of upland rice, interplanted with ochra, maize, pumpkins, and groundnuts. The longer-lived plants are banana, sugar cane, and papaya. The short-lived crops are replanted again and again for there is no rest period caused by either drought or cold. In Figure 278 are shown some of the varied products brought fresh to the market. Here are shown bananas and plantain, manioc, sugar cane, maize, eggplant, peppers, beans, cowpeas, sweet potatoes, yams, groundnuts, voandzeia, oranges, limes, anona, papaya, Brazilian tomato, snuff made from locally grown tobacco, and eggs. There seems to be almost no plant that cannot be grown under these conditions with the exception of those that require temperatures above 85 degrees F. Consequently, such tropical crops as rubber, cacao, oil palm, ginger, and vanilla are absent.

In addition to the crops mentioned, fruits of many kinds do well. Natives use the papaya, anona, breadfruit, and mango. Sugar cane grown on rich land is used as a food; the stems are chewed to extract the juice. It is a very prominent product in all markets and is carried by traveling natives as an emergency food.

Ethiopia is to quite an extent a self-sufficient country. Up to a few years ago there was little European agriculture. The land was sown and prepared by a plow (Figure 7), well adapted to stony land but not used south of Ethiopia. One operation prepared the soil and covered the seed and left the surface broken and rough (Figure 152), excellently adapted to absorb rainfall. Here agriculture has reached an advanced stage and the crops are largely wheat, barley, teff, and chickpea. Teff (*Eragrostis teff*) is sown on the black cotton soils which when wet are puddled by driving domestic livestock through and the seeds scattered on the surface. In a short time, from six to eight weeks, the crop is ripe. This grain is preferred over any other for making bread. In this region almost any temperate field, vegetable, or fruit crop can be grown. Over most of the area foods are locally produced. They vary somewhat in locality but are chiefly banana, maize, manioc, rice, sweet potato, yams, sorghum, eleusine, pennisetum, sugar cane, pumpkin, squash, cucumber, Colocasia, onion, beans, peas, cowpea, pigeon pea, soy bean, horse bean, ricinus, Coleus tuberosus, tomato, eggplant, groundnut, voandzeia, peppers, chillies, papaya (Figure 230), anona, citrus fruits, coffee, tobacco, and especially in Ethiopia, wheat, teff, barley, emmer, flax, potato, plums, peaches, oranges, lemons, apricots, blackberries, raspberries, grapes, Musa ensete, banana, and coffee.

European agriculture.—European agriculture in these highlands is largely in Kenya and Nyasaland, also in Tanganyika and Uganda where plantation systems have been set up. Naturally, export is the chief objective. A good idea of the potentialities can be ob-

tained from the agricultural census of Kenya. A part of this list might come from the Lake States of the United States in so far as the items are concerned. However, truly tropical products are also produced. It starts out with maize, wheat, barley, oats, beans, peas, potatoes, lucerne, flax, all of which are produced in this region and then adds coffee, sugar cane, sisal (Figures 28 and 69), wattle, apple, pear, peach, plum, apricot, nectarines, oranges, naartje, lime, grapefruit, fig, guava, quince, papaya, and custard apple. However, on the basis of acreage, the crops range as follows: maize, sisal, coffee, wheat, barley, sugar cane, and tea. In Nyasaland they are tea, sisal, maize, coffee, and wheat, while in Uganda they are coffee, with a small acreage of tea, cotton, and maize. Ceara rubber has been planted in parts of the region (Figure 235).

Livestock.—Cattle are the most important animal product of this region. They are probably most abundant in Ethiopia, followed in order by Tanganyika, Kenya (Figure 229), Uganda, and Urundi and Ruanda. The total is about 8,923,000 or an average of about 21 per square mile. Much of the area is forested and practically free of cattle, and if a correction is made by eliminating the forested area, the density becomes about 28 per square mile.

Sheep and goats (Figure 62) are not as important and number only about 16,505,000, mostly in Ethiopia, Kenya, Uganda, and Tanganyika. Pigs are next and are confined largely to Madagascar, Nyasaland, and the Congo, with a smaller number in Angola, Kenya, and Northern Rhodesia. The total is about 199,000. Donkeys are mostly in Tanganyika, Kenya, Uganda, and the French Cameroons, and number only about 38,000. There are about 10,000 horses, mostly in French Cameroons, Kenya, Angola, and French Guinea. Undoubtedly they are more numerous in Ethiopia than in any of the recorded areas. The total use of forage by cattle and sheep and goats as expressed in animal units would be about 30 per square mile for the whole area or 38 per square mile for the non-forested area. Poultry and bees (Figure 69) are important.

Crops for export.—The exports from this region are largely coffee (Figure 26) since it is grown almost exclusively for that purpose. It ranks first in Ethiopia and Kenya and high in Uganda and Tanganyika. In Nyasaland tea is important. Comparatively little of these tropical highlands are under European cultivation. This is partly due to the natural dense population of aristocratic native peoples who have dominated the areas and have not readily become subservient. Animal products are more important than any crop but in European trade appear only as hides which are in some cases only made available by stringent regulations against local consumption. Butter is also exported (Figure 178).

Land under cultivation.—The record of cultivated land is very inadequate since there are no records for Ethiopia. For the area as a whole small grains, wheat, barley, oats, and rye probably exceed all others, although the record available indicates only about 108,000 acres outside of Ethiopia, where there are probably from five to eight million acres of small grains grown. On the basis of records, such as they are, sorghums and millets amount to about 840,000, manioc 783,000, and maize 869,000 acres. Coffee is next with about 369,000 acres, mostly Arabian coffee, and principally in Tanganyika and Kenya, with smaller acreages in Angola, Madagascar, Uganda, and Portuguese East Africa. In Kenya, coffee is grown

only by Europeans (Figure 26) and in Tanganyika largely by natives (Figure 56). Small grains, wheat, barley, oats, and rye are next with about 114,000 acres, most of which is in Kenya. If Ethiopia were included this estimate would be increased by from five to eight million acres. A rough estimate would place the acreage of land under cultivation in this region at 40,000,000 acres or 15.3 per cent of the total area. Probably half of this is in Ethiopia.

Crop potentialities.—It is difficult to overstate the importance of this land as a potential agricultural area. Lying as it does near the equator and at high enough elevation to preclude high temperatures and rather evenly supplied with rainfall, it can produce any crop of the temperate zone and in addition most tropical fruits and vegetables. The only crops shut out are those which require continuous high temperatures. This list is surprisingly small. Therefore, here can be grown the small grain crops, wheat, barley, oats, rye, and teff. Flax, hemp, bananas, coffee, and tea also thrive. Vegetables of all sorts can be grown such as potatoes, sweet potatoes, yams, Colocasia, manioc, beans, peas, pigeon peas, chick peas, soy beans, cowpeas, horsebeans, pumpkins, squash, luffa, gourds, cucumbers, melons, sweet peas, garden peas, Canada peas, cauliflower, cabbage (Figure 180), tomatoes, eggplant, chillies, peppers. Coleus tuberosus, Musa ensete, and most of the mustards. Some of the warm-weather crops such as rice, sugar cane, maize, sorghum, pennisetum, eleusine, and tobacco do well almost everywhere. Citrus fruits such as orange, lemon, tangerine, lime, grapefruit, loquat, and citron, also deciduous fruits such as apple, peach, pear, apricot, plum, cherry, quince, and such small fruits as blackberries, raspberries, and grapes grow here. Wattle, sisal, and lucerne also do well here. It is an ideal pasture land where natural grasslands maintain themselves in a productive state throughout the year. Small grains, deciduous fruits and vegetables, as well as citrus fruits, legumes, and warm-weather cereals can be grown. Besides these, banana, coffee, and tea find this cool weather, free from low temperatures, ideal.

Probably as time goes on coffee and banana will stand out as the principal cultivated crops and cattle as the most valuable animal product.

If the tropics is ever settled by a large European population, these highlands will become a necessary recreational asset to the surrounding lowlands.

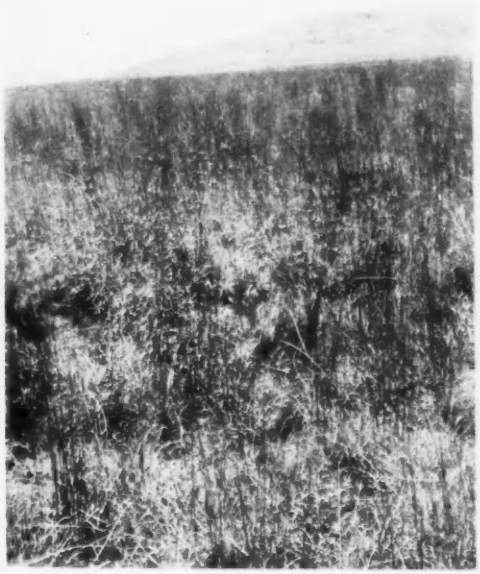

FIGURE 279.—Tall grass is used both for pasture and for the production of native hay. Most of the grasses are "sweet grasses," eaten by cattle in contrast to the "sour grasses" which are not eaten. Rooi grass (*Themeda triandra*), here shown, is one of the most valuable native grasses. Pretoria, Transvaal.

10. CATTLE AND MAIZE REGION

(*See* 10 on the map)

This area includes the high veldt of the Transvaal, Orange Free State, Basutoland, and eastern part of Cape Province as well as small highland areas in Southern Rhodesia and southern and western Natal. Much of this area is on the high southern plateau and is known as the high veldt, at elevations between 5,000 to 10,000 feet, but it extends down to 2,000 in the eastern Cape Province. The total area is about 124,000 square miles.

Natural vegetation.—About 2,000 square miles on the east slopes of the Drakensberg is of temperate rain forest and about 28,000 square miles in the eastern Cape Province is of Acacia–tall grass savanna. About 94,000 square miles of this area is a tall-grass country (Figure 279). It is often referred to locally as a short-grass country but this is by comparison with the very tall grasses of the low veldt. It corresponds more nearly to the Oklahoma and Texas tall-grass areas than any other portion of the United States and looks very much like it (Figure 280).

Rainfall, temperature, and soils.—Rainfall for the most part is between 20 and 35 inches but reaches 50 inches on some of the highest areas and along the east slopes. It is summer rainfall, most of which falls between October and March. Thunderstorms are frequent although the temperature seldom rises above 85 degrees F. The drought period is in midwinter, from May to September.

Temperatures are greatly influenced by elevation, and the more tropical crops are shut out by winter temperatures well below the freezing point. The winter rest period extends from May to August. Except at high elevations snow is not common and has been recorded on the Transvaal only eleven times in 57 years. At Johannesburg, temperatures range from 23 to 90 degrees F.

The soils in this area vary from the redder or southern type of chernozems to the red loams. Where rainfall is sufficient to leach through and carry off the carbonates, the soils are similar to our southern prairie soils.

Fauna.—Under natural conditions this area was excellent grazing land although much of the upland was not strictly year-long grazing land. The fauna of this area was unusually rich and included such well-known game animals as the springbuck, one of the most prominent and the only true gazelle found in South Africa. Others were the blesbuck, steenbok, inyala, gemsbok, tsesebe, wildebeest, hartebeest, zebra, roan and sable antelope, as well as the kudu, white rhinoceros, and the elephant. The lion, cheetah, leopard, and many other cats, jackals, and hyenas were found here. Many of them still remain but such large game as elephant, rhinoceros, giraffe, hippopotamus, and eland are practically unknown in the Transvaal and Orange Free State today. At the present time steenbok and other small bucks, warthog, and hares, besides eleven species of francolin, five of quail, three of guinea fowl, four of sandgrouse, eleven of bustard, two of dikkops, three of geese, thirteen of ducks, and three of snipes afford good hunting. The wild ostrich is regarded as fair eating, and the great kori bustard next in size, which sometimes stands five feet high and weighs forty pounds, is excellent eating. Birds of outstanding interest here and in the other regions are the marabou stork which produces plumes prized above almost all others and the secretary bird, a large and

FIGURE 280.—A residence on a ranch of ten square miles which is not regarded as large for this region. Here 20 to 30 bushels of maize are produced per acre, and one cow is grazed on three acres of native pasture. Home of J. Burtt-Davy, Vereeniging, Transvaal.

attractive bird which is protected largely because it kills snakes.

Peoples.—At the time of the arrival of the Europeans this area was occupied by the Bechuana, Matabele, and Basuto, all a part of the Zulu group, known under a general name "Kafir" which was applied by the Arabs to the inhabitants of the east coast and means "unbeliever." These peoples lived on the wild game, reared their domestic animals and planted sorghum, maize, beans, and vegetables. Except for Basutoland, this region is now thoroughly Europeanized.

Natural production.—This grassland supported a large number of game animals which produced meat, hides, and ivory for the native peoples.

Crop production.—Native peoples here were partly or largely dependent on cattle, sheep, goats, and horses, and such crops as sorghum, maize, and wheat which are now important in Basutoland. Except in Basutoland, the agriculture of the natives is based on the production of maize and cattle, with sheep a very important part of the economy.

Hay is an important crop (Figure 281) and pastures are often of native grasses or improved by the growth of introduced species. The carrying capacity of the high veldt is usually high during the summer period but low during May to September. So important are the natural pasture lands that careful control of the amount of grazing and rotation grazing is practiced. The hay crops to carry stock over winter are chiefly lucerne, Sudan grass, teff (*Eragrostis teff*), buffalo grass (*Panicum maximum*), Paspalum (*Paspalum virgatum*), manna (*Setaria*), and Rhodes grass (*Chloris gayana*). Attempts to increase the winter pasturage are made by introducing such grasses as Paspalum (*Paspalum dilatum*), tall fescue (*Festuca arundinacea*), toowoomba canary grass (*Phalaris bulbosa*), rye grass (*Lolium perenne*), cock's-foot (*Dactylis glomerata*), Chewing's fescue (*Festuca duriuscula*), and Digitarias. These common names are the ones used in South Africa. Many of the legumes such as cowpea, velvet bean, soya bean, Dolichos lablab, and the various vetches are grown for green manure and for feed.

Teff is important for it requires only eight weeks to produce a crop and often three cuttings of from two to four tons per acre can be secured in a year.

Maize fits admirably into the economy of the region, the grain is a source of food for livestock, and ensilage made of green maize is a most important winter feed.

Livestock.—Cattle are grown for trans-

FIGURE 281.—The hay market, where hay, chiefly native rooi grass, teff, and alfalfa are auctioned to the highest bidder. Johannesburg, Transvaal.

portation purposes (Figure 224) and for heavy farm work. Ox teams of from 16 to 18 animals travel 18 to 30 miles a day and although their place is now largely taken over by mechanized transportation, the ox is still important. For this purpose a strong, hardy, and self-reliant animal was developed known as the Afrikander derived from *Bos indicus* rather than *Bos taurus*.

It is on this native stock that most of the breeders have relied for qualities of hardiness and adjustment to a warm climate (Figure 282). European breeds from *Bos taurus* do not thrive in any but the cooler portions of the area. Cattle are important throughout this region and are especially abundant in the eastern Cape Province. These animals, except for their hides, are used mostly for home consumption (600,000 head annually), and the export of chilled beef has not yet equalled many other less important products.

The estimated number of cattle in the region as here considered is about 8,300,000, of which the larger number 2,700,000 are from eastern Cape Province, 1,900,000 from Orange Free State, 1,600,000 from Natal, 1,500,000 from Transvaal and 600,000 from Basutoland.

This is a rather dense population, amounting to about 67 per square mile for the whole region.

Sheep and goats are much more numerous, totaling 40,900,000. They are most numerous in the eastern Cape Province, totaling 18,400,000. In Orange Free State 12,100,000 are recorded; in Transvaal 4,300,000; in Natal, 3,300,000; and in Basutoland 2,800,000. The total amounts to 330 per square mile.

Sheep are much more numerous than goats. Of the total 40,900,000, about 34,800,000 are sheep and 6,100,000 goats. Of the sheep, about 30,900,000 are owned by Europeans and about 3,900,000 owned by natives. Of the goats 2,500,000 are European-owned and 3,600,000 owned by natives.

If cattle, sheep and goats were combined they would number about 16,480,000 animal units or 132 per square mile for the whole region.

The sheep have been improved from the original leggy, hair-bearing, fat-tailed or fat rump sheep to the fat-tailed Afrikander and blackhead Persian, and are now largely of the best-wooled merino type. In fact, the latter are now about nine times as numerous as the non-wooled sheep.

Goats are valuable for skins and mutton and have been greatly improved over the original stock. Angora goats raised to produce mohair are about as abundant as common goats in the Orange Free State but for the region as a whole there are about five common goats to one Angora.

Horses originally of Arabian and Persian blood are now of thoroughbred strain of a type predominantly South African. There are about 828,000 in this region. They are most numerous in eastern Cape Province where there are about 280,000 and in Orange Free State where they number 246,000. Smaller numbers are found in Basutoland 154,000, Transvaal 82,000, and Natal 66,000. Of these, practically all in the Transvaal and Orange Free State are owned by Europeans; in Basutoland practically all by natives, and three-fourths in Natal and nearly two-thirds in Cape Province are owned by Europeans.

Pigs are next in number and total about 515,000. Of these about 180,000 are from the eastern Cape Province; 139,000 from Transvaal; 114,000 from Orange Free State, and 82,000 from Natal. They are rather evenly divided between European and native ownership.

Donkeys number about 348,000, being most numerous in eastern Cape Province

where there are about 123,000 and in Transvaal 122,000, and lesser numbers in Natal 66,000, and Orange Free State 49,000. Of these the Europeans own about three times as many as the natives.

Mules are not common, there being only about 74,000. About 41,000 are found in the eastern Cape Province; 15,000 in Orange Free State; 12,000 in Transvaal; 5,000 in Natal, and 1,000 in Basutoland. Natives own a very few of these.

Poultry is important. Fowls far exceed other types and are most numerous, amounting in European ownership in 1926 to about 5,000,000 for this region. Ducks number about 200,000, turkeys about 150,000, and geese 100,000.

Bees are also important, there being about 35,000 hives in 1926. These estimates, however, do not include those owned by natives.

Crops for export.—Maize leads all other crops in this region, the total acreage being 3,965,000. The Orange Free State leads with 2,486,000 acres. The Transvaal, and in this region that includes only the high veldt, has 1,020,000, the southern and higher portion of Natal 207,000 acres and eastern Cape Province 252,000 acres. Excellent dent varieties predominate and most of the crop is consumed both as feed for domestic livestock and as food for man.

FIGURE 282.—A dipping tank, six feet wide, to accommodate large-horned cattle. It is essential to protect cattle from ticks which not only weaken the cattle but carry diseases. Vereeniging, Transvaal.

Small grains rank next to maize in acreage of cultivated crop with about 830,000 acres. Forage and hay are important but much of the latter is cut from the native grasslands. Lucerne is an irrigated crop and while important, the acreage is small. In the Orange Free State and Transvaal this crop probably does not exceed 30,000 acres. Teff is much more important and for the same region probably amounts to 200,000 acres. It is an excellent crop requiring only about six to eight weeks to mature. Sorghum and millet are relatively unimportant, the acreage being about 90,000.

The exports are not a true measure of agricultural production since many of the important products are consumed locally. However, wool leads from South Africa and if three-fourths of this export comes from this area it would amount in 1928 to about $61,000,000. Maize amounted to about $17,000,000 and hides and skins about $16,500,000, or nearly the same amount. Although many other products are exported, these stand out in this region as the most valuable.

Land under cultivation.—The total acreage under cultivation, as recorded, is about 6,921,000 acres. This is, however, very incomplete and it is estimated that the area under cultivation is about 7,900,000 acres or 10 per cent of the total area. Much of the land is pasture land, intensively used for agriculture but not actually under cultivation.

Potentialities.—The potentialities of this area are well expressed in present production. Sheep and cattle are ideally adapted. Maize is the chief crop with forage, small grains and deciduous fruits all important. It is fairly densely populated, is well stocked with domestic animals and about 10 per cent of the land is under cultivation.

11. SUBTROPICAL FRUITS AND VEGETABLES, SMALL GRAINS, TIMBER, AND LIVESTOCK REGION

(*See* 6 on the map)

This region occupies the southern extremity of Africa, known as the Cape Region and the northwest extremity or Mediterranean and Atlas Mountain region of Morocco, Algeria, and Tunis, and the small northern portion of Cyrenaica. It totals about 241,000 square miles.

This region stands out as the most developed of any portion of the continent.

Natural vegetation.—The natural vegetation of these regions is a sclerophyll brushland (Figure 109), with forests developed at higher elevations. At lower elevations the brush is sometimes replaced by grassland but this under natural conditions would probably soon be replaced by brush. Moreover, the brushland would probably be replaced by larger trees, if it were not that conditions are ideal for fire and much of this type is burned over every few years. There are about 241,000 square miles of this type of land in Africa if the oak-conifer forest is included. Most of this is in North Africa and only about 39,000 square miles in South Africa. Africa has a fifth of the world area of this type, which is prized the world over for its climate and varied production.

In North Africa there are areas covered with dwarf palm and temperate grass which have been derived by use from the sclerophyll brushland or maqui and from oak forest. In the north the oak forest and coniferous forests are relatively open and usually afford pasturage. The brushland is relatively poor pasture land, both in the north and in the south. The relatively luxuriant growth of bushes and small trees is burned over every few years due to the dry summer climate and the close stand of plants which are especially inflammable. They practically all sprout up from the roots and this type is regarded as a fire stage in succession. However, this plant community occurs under these conditions at widely scattered areas on the earth's surface (Figure 253). It is found in the chaparral of California, the Mediterranean region in Europe, Asia and Africa, in southern Australia and in central Chile in South America. While the species of plants are quite distinct in the different continents, they are much alike from the ecological point of view and indicate similar soil and climatic conditions (Figure 283).

Rainfall, temperature, and soils.—Rainfall is from 20 to 35 inches, coming mostly during the cool part of the year. A three- to five-month drought period is more marked in the Mediterranean region than in the Cape region. During the rainy period the country appears to be very humid, the soils become thoroughly saturated probably partly due to the heavy subsoil, and dirt roads are often almost impassable.

Drought is extreme on the desert side, but here irrigation extends the productive area beyond the natural confines of this region. This is true north of the Cape region and south of the Mediterranean region. However, the supply of water is not great and the boundaries have been only slightly extended. On the desert side drought is much more of a factor than on the littoral side.

This region lies about 35 degrees north or south of the equator, and temperatures range from a few hours with temperatures below 32 degrees F., to a few hours with temperatures above 100 degrees F. There are frost-free

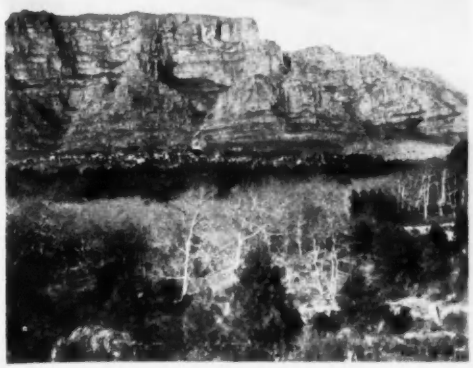

FIGURE 283.—The natural forests of the Cape region are enriched by many European and American trees. Here are shown the European oak and pine (*Quercus pedunculata* and *Pinus pinea*). Many California species thrive here. Table Mountain, Cape Town, Cape Province.

places but as a rule temperatures may fall a few degrees below freezing but not below 26 degrees F. at which temperature citrus trees are injured permanently. The range is for the most part from about 28 to 100 degrees F. but in some places temperatures as high as 120 degrees F. are recorded. These high temperatures come during the middle of summer in the dry part of the year. At higher elevations temperatures may fall to seven degrees F. This is usually above the agricultural area.

The soils are brown, reddish brown, or red, with little calcium present, due to the leaching by winter rains. The subsoils are likely to be heavy and most of these soils respond to mineral and organic fertilizers. Topographically the areas are young and many new areas of soil materials have been deposited from the mountains above. Consequently, soils are extremely variable. Since the summers are warm and the winters cool there are really two climates, a cool winter climate and a warm summer climate. Small grains do exceptionally well in winter. The moisture supply in winter is hardly sufficient to carry through the summer and irrigation is usually practiced for all but the annual crops.

Fauna.—In the north the native fauna has been largely destroyed by the dense human population. Here there was once a rather rich fauna including the Barbary lion, Barbary ape, leopard, wildcat, and striped hyena of Asiatic affinity, the brown bear, Barbary deer, and wild boar of European affinity, and certain African forms such as the Mediterranean goat and more desert types such as gazelles, white oryx, and addax. South Africa, settled the middle of the 17th century, had a very rich fauna. Lion and elephant were common in and about Cape Town, and the hippopotamus was protected as early as 1677 and in order to protect cattle the reward paid for a dead lion was raised to £5 4s. 2d. or equivalent to about $25.00 in 1694. Among the more important animals were Cape hartebeests, duikers, greater kudu, Cape bushbuck, eland, bontebok, blesbok, gemsbok, warthog, springbok. rhinoceros, giraffe, Cape mountain zebra, quagga, buffalo, wildebeest, klipspringer, vaal reebok, chacma baboon, and vervet monkey. There were also many birds and a rich fauna of small animals. It is not surprising that so varied a physical type should have so rich and varied a fauna and flora.

Peoples.—The native inhabitants of this region are less numerous in proportion to Europeans than in any other region in Africa. In the south they were chiefly Hottentots (Figure 243) but since the European occupation there is now a mixture of Hottentot, Bushmen (Figure 242), and Bantu peoples and a large population of colored who are partly white and are enumerated with the Europeans. The native peoples are about three times as numerous as the Europeans. In North Africa the natives are the Moors, largely Arabs, and the

Kabyles or Berbers in Tunis, Algeria, and Morocco. There are about ten times as many natives as Europeans. The Berbers (Kabyles) are cultivators of the soil and the Arabs (Moors) are mostly herders.

Natural production.—The natural products of this region in the south are relatively unimportant. It is not especially good grazing or browsing land or good timber land. Game animals contributed meat and hides and in the south ivory and rhinoceros horn. In the north halfa and palm fiber are important natural products as are also bark from cork oak. Here also are produced saw timber, resins, charcoal, and firewood from Aleppo and Mediterranean pine; pipe bowls from Erica, and tannin from oak bark.

In North Africa the cork oak (*Quercus suber*) is one of the most important trees since it furnishes a crop of cork about every ten years. Holly oak (*Q. ilex*) and afares oak (*Q. afares*) are also important for timber, wood and tannin. The oaks also contribute mast for animals, and olives and belotes (*Quercus ballota*) produce food for man. Other important trees are Aleppo pine (*Pinus halepensis*) and Thuya (*Callistris articulata*) and especially atlas cedar (*Cedrus libanotica atlantica*) which is a large tree in extensive stands and is valuable for both for the timber and the turpentine it produces. Cluster pine (*Pinus pinaster*) grows close to the sea, is especially valuable to control sand dunes and also produces wood and turpentine. On the desert side, juniper (*Juniperus phoenicea*) is abundant and is valuable for wood, posts, and small timbers.

In North Africa domestic livestock lives on the grasslands and in the open forests, for there is more open country than in South Africa. Forests as well as grasslands are productive forage areas.

In the south the principal timber trees are real yellow-wood or Podo (*Podocarpus thumbergii*) and common yellow-wood (*P. elongata*) used for building, flooring, furniture, and construction purposes; Assegai (*Curtisia faginea*) for wagon-wood; black stinkwood (*Ocotea bullata*) for furniture and wagon-wood; ironwood (*Olea laurifolia*), white pear (*Apodytes dimidiata*) for wagon-wood; and Kamassi (*Gonioma kamassi*) exported to Europe for the manufacture of shuttles. Clanwilliam cedar (*Widdringtonia juniperoides*) is a light, durable softwood, and sneezewood (*Ptaeroxylon utile*) is one of the most durable timbers valued for fence posts.

In addition to the natural economic products, this region has enriched the gardens of the world by producing such prized ornamental plants as the calla lily, many beautiful species of gladiolus, pelargonium, aloe, freesia, cotyledon, mesembrianthemum, protea, erica, euphorbia, many attractive plants from the composite lily, iris, amaryllis, and orchid groups. Wild flowers are a commercial product in Capetown (Figure 284). The flower stalks of chinkerichee (*Ornithogalum thyrsoides*) are cut and shipped without special packing or refrigeration to England where when placed in water they continue to bloom for several weeks.

Agricultural crops.—North Africa is a very old country, occupied principally by Europeans, Berbers, and Arabs, and South Africa has been settled by Europeans as long as has America and is now populated mostly by Europeans, Bantus, and Hottentots. Here it is more difficult than in any other region to separate European from native production and export production from local food production. While almost any crop grown may at times be marketed and exported, there is not the sharp distinction between food and

money crops found in the central African regions. North Africa is really a part of southern Europe and has served as a great source of cereals, wines, fruits, and vegetables for the adjacent European countries. South Africa has a larger hinterland to serve but still ships much of its crops of vegetables, fruits, and grains directly to England.

On the basis of acreage, small grains far exceed any other crop. These consist of wheat, barley, oats, and rye. The total acreage of small grains for this region is about 17,623,000 acres. Most of this is in Algeria where there there are 7,991,000 acres and in Morocco where there are 6,360,000 acres planted to small grains. Tunis is next with an acreage of 2,320,000 and Cape Province with 826,000 and Tripolitania and Cyrenaica with 126,000.

Wheat, which totals about 8,820,000 acres, occupies the greatest acreage. Here Algeria leads with about 3,798,000 acres, followed by Morocco with 3,010,000, Tunis with 1,377,000, Cape Province with 610,000 and Tripolitania and Cyrenaica with 25,000.

In South Africa wheat is grown as a winter crop, planted in April and May, and harvested in October, November, and December. In North Africa both the durums and soft wheats are grown as winter crops, planted in autumn and harvested in May, June, and July.

For the region as a whole, Europeans produce about 2,259,000 acres of wheat and natives about 6,550,000 acres.

Barley is almost as important as wheat, the total acreage being 7,746,000 acres. Algeria leads with 3,535,000 acres, followed by Morocco with 3,229,000 acres. Tunis produces 900,000 acres and Cape Province 62,000 acres. For the region as a whole the natives produce 7,149,000 acres and Europeans 597,000 acres, since barley is a preferred food in many places by the natives both for man and for livestock. It is also pushed farther toward the desert lands.

Oats are by no means as important as wheat and barley. The total acreage is about 1,236,000 acres, of which 400,000 are in Cape Province, 639,000 in Algeria, 108,000 in Morocco and 89,000 in Tunis. Europeans produce about 992,000 acres and natives only 244,000 acres. Most of the latter is in Algeria, and a small amount in Tunis.

Rye, totaling about 100,000 acres, is grown in Cape Province.

Maize is a relatively important crop in Morocco where about 600,000 acres are grown, mostly by natives. The total maize production for the region is only 617,000 acres.

Sorghums and millets are even less important than maize and total only about 263,000 acres. This is mostly in Algeria.

Peas and beans are important in this region. A great variety are grown, chief among which are navy beans and string beans, Canada and garden peas, soy beans and cowpeas. Broad beans are also grown as a winter crop. In the north, lentil and fenugreek are grown as well as the garden pea and Canada pea. Most important of all are the many varieties of the common bean or haricot. A very important crop in the north, especially in Morocco, is the chick pea (*Cicer arietinum*), of which probably 145,000 acres are grown; it is prized as a food. It is planted usually in February and March.

The potato is also grown in this region, principally in Algeria and in Cape Province. The total acreage is not large, amounting to about 58,000 acres.

Fruit is of major interest in this region and in similar regions throughout the world. The data are not comparable or available to give acreages except in a few cases. Even in South Africa it is

difficult to separate the production in this Cape region from that of the rest of the country. It would seem that about two-thirds of the deciduous fruit produced in Cape Province would come from this area and a similar proportion of the citrus trees. This would mean about 377,000 citrus trees and 940,000 deciduous trees. The total acreage is about 58,000 acres. To these should be added over 100,000,000 vines, occupying an acreage of about 60,000 acres.

In North Africa the olive takes probably first place since there are about 30,000,000 olive trees, about half being in Tunis and a third in Algeria. Many of these are native trees, some of which are grafted with selected varieties.

Vines are of great importance and Algeria leads with 1,670,000 acres. Tunis has about 100,000 acres, Morocco 10,000, and Cape Province 60,000 (Figure 25), to make a total of 1,840,000 acres.

Citrus fruits are not relatively as important in North Africa as in South Africa. Roughly, the total number of trees in Morocco is 242,000, in Algeria 1,700,000, and in Tunis 121,000, or a grand total of 2,063,000 which probably covers an acreage of about 21,000 acres. Cape Province has about 188,000 trees grown for export, making the total of citrus trees for the region 2,250,000 occupying about 22,500 acres. Deciduous fruits are important in South Africa where there are nearly a million trees.

Under European occupation, South Africa has become an important fruit-producing area. Since it lies in the southern hemisphere its fruit crops come to market at the most opportune time and supplement the Mediterranean and California market by producing fresh fruit in the period of highest prices.

Deciduous fruits do especially well and grapes (Figure 25) are a major industry. The fruits grown on a commercial scale include deciduous fruits such as grapes, peaches, apricots, plums, pears, apples, and quinces, and also nectarines, oranges, tangerines, grapefruit, pineapples, melons, mangoes, litchis, lemons, grenadillas, avocados, pomegranates, persimmons, and tomatoes, all of which are exported, and also Cape gooseberries (*Physalis*), cherries, custard apples, figs, guavas, limes, loganberries, loquats, olives, papayas, raspberries, strawberries, and currants. Wine is one of the principal exports, but table grapes, citrus and other fresh fruits, raisins, currants, and prunes are important. The most valuable fresh fruits exported are oranges, followed by grapes, pears, other citrus fruits, apples, plums, peaches, lemons, pineapples, nectarines, and apricots.

Vegetables rank high in importance in this region. Almost any vegetable, herb, or small fruit wanted for the garden can be grown, such as artichoke, tomato, lettuce, potato, chard, endive, chick pea, lentil, fenugreek, broad bean, parsnip, ochra, peas, beans, sweet potato,

FIGURE 284.—Native wild flowers, proteas, callas, wattle, chinkerichee, and a great variety of other plants are sold in the market on Adderley Street, Cape Town.

chicory, beet, turnip, carrot, cucumber, watermelon, cantaloupe and similar melons, squash, pumpkin, gourds, tobacco, henna, saffron, madder, rose geranium, bergamot, coriander, mints, cumin, fig, opuntia, banana, celery, parsley, cabbage, kale, kohlrabi, brussels sprouts, spinach, asparagus, onion, garlic, cauliflower, radish, salsify, eggplant, peppers, strawberries, raspberries, guava, carissa, almond, and walnut. In fact, almost any crop except those which require a continuous moist warm season, or a continuous warm season may be grown. The low temperatures here are not sufficient to kill most plants but do shut out truly tropical crops. It is in a real sense a semi-tropical region.

Livestock.—Livestock is a very important part of the agriculture of this region. Goats and sheep are the most numerous, totaling about 17,700,000 of which 12,000,000 are sheep and 5,700,000 are goats. Morocco leads in numbers with 7,700,000, followed by Algeria with 4,600,000, Cape Province with 3,000,000, Tunis with 2,200,000, and Cyrenaica with 200,000. This total amounts to about 74 per square mile.

Cattle number about 2,296,000. Here again Morocco leads with 1,261,000. Algeria is next with 450,000, followed in turn by Tunis with 315,000, Cape Province with 266,000, and Cyrenaica with 4,000. This total amounts to 9.5 cattle per square mile of the whole area.

There are only about 296,000 pigs; 180,000 in Cape Province, 75,000 in Algeria, 31,000 in Morocco and 10,000 in Tunis.

There are about 66,000 horses in Morocco, 54,000 in Algeria, 31,000 in Tunis and 30,000 in Cape Province or a total for this region of about 181,000.

Mules are less abundant but there are 65,000 in Algeria, 41,000 in Cape Province, 30,000 in Morocco, and 10,000 in Tunis, or a total for this region of 146,000. Donkeys are more abundant. Morocco has about 180,000, Cape Province 123,000, Algeria 98,000, and Tunis 54,000, or a regional total of about 455,000.

In Cape Province there are about 53,000 ostriches in this region.

This heavy animal population amounts to about 25 animal units per square mile of the whole regional area. If based on sheep, goats, and cattle alone, it amounts to 23 animal units per square mile.

Poultry of all kinds does well and egg production yields an important agricultural product, especially in Morocco and Cape Province. The climate is especially suited to turkey farms, and poultry is produced both for meat and eggs.

Bees likewise are developed in this region and both honey and wax produced in quantity.

Crops for export.—In actual value of the exports wines lead, valued roughly at about $75,000,000 annually, most of which comes from Algeria. Cereals are next in value, amounting to about $20,000,000 annually. Olive oil and animal products probably amount to about $8,000,000 each. Fruits and vegetables are important. Such unusual products as canary seed, coriander, cumin, and fenugreek total about $1,000,000, and palm fiber $1,500,000 annually from Morocco alone.

North Africa, because of its nearness, furnishes a great variety of fruits to the European markets. Chief among these are table grapes, raisins, and wines produced by grapes, olives and the oil produced from them, and oranges, lemons, and almonds. In addition, cereals, legumes, fruits, and vegetables of many kinds find a ready market.

These areas are especially productive. Based on agricultural land, the produc-

tion of exports is highest in Algeria, $2,222 per square mile, followed by Tunis $1,902, Union of South Africa $551, and Morocco $480 per square mile of agricultural land. This is not fair to the Cape Province for there, only a small portion of the land is strictly agricultural and the figures are for the Union. It is probable, that for this type of land Algeria and the Cape Province are almost equally productive, acre for acre.

On the whole, this region is rich in exports and also in consumption of materials produced. The agricultural exports amount to about $900 per square mile of the whole area. This high production is due first to the specialized production of valuable products and second to the fact that land is productive practically throughout the year. The rest period which from the standpoint of temperature seldom stops growth of cool-weather crops and the drought period is overcome by cultivation and thin planting or by irrigation.

Naturally, North Africa does not have the advantage of having its midsummer in December and January as does the Cape region.

Land under cultivation.—The acreage of land under cultivation totals about 27,200,000, of which by far the greatest acreage, 17,600,000, is in small grains. Vines total an acreage of about 1,840,000. It is probable that about 30,000,000 acres are actually under crop or about 20 per cent of the total area.

Crop potentialities.—The crop potentialities of this region are so great and the varieties of crops which can be grown are so numerous that even a list of the names would be entirely too long for this paper. Briefly, two types of crops can be grown. The cool-weather annuals such as small grains do well as winter crops. Vegetables of the cool-weather type such as broad bean, turnip, lettuce and garden pea can be grown successfully in winter. Warm-weather crops such as sorghum, corn, and cotton can be grown in summer if not shut out by more profitable use of the land for vines, olives, citrus and deciduous fruits, semitropical fruits and vegetables. The only crops shut out are the warm-weather high-humidity tropical crops and those which are perennial and cannot stand low or even freezing temperatures. This permits such fruits as citrus, avocado, papaya, pineapples, mangoes, litchis, and bananas, and all of the deciduous fruits and small fruits, and a great variety of vegetables. Here are brought together most of the world's fruits, vegetables and ornamental plants, and probably a greater variety are grown than in any other region. It is not so distinctly different from the livestock, cool-weather crops and timber region of the highlands of the tropics. They are similar in that a great variety of plants can be grown. The difference is largely in the long, dry, hot summer in the subtropical fruit region which favors certain crops and is unfavorable to others. This region differs in that there is a distinction between winter and summer and that the crops have to be adjusted to this difference while in the livestock, cool-weather crops region the conditions are not very different from month to month and there is not a marked drought period. Both are wonderfully productive areas.

Livestock finds here a favorable climate, and poultry and bees are important in this region. In fact, it is sought out as a region favorable to man and beast alike.

12. SUGAR CANE, BANANAS, AND COCONUTS

(*See* 3 on the map)

In Southeast Africa the warm, damp coastal area is sometimes called the Palm Belt. It is less tropical than the clove, coconut, and banana region and has been separated from that region largely because cloves are not grown here. It extends south along the coast of Portuguese East Africa from about 200 miles north of the mouth of the Zambezi River, occupying north central Portuguese East Africa below the 1,000-foot contour and extends inland in places to a distance of about 300 miles. It extends south along the coast of Natal in a narrow belt to the southern boundary of Natal. This area includes about 111,000 square miles.

Natural vegetation.—The vegetation is Acacia–tall grass savanna for the most part. In many places trees become more numerous and produce a dry forest, and at times, especially along the coast, there is an evergreen phase which could be placed in the temperate rain forest. Generally, these are dense growths of small trees almost impenetrable at times. A great part of the area is a savanna with trees and palms scattered throughout.

Rainfall, temperature, and soils.—The rainfall in this region is rather high, ranging from about 30 to 50 inches and coming mostly in summer. The wettest month is usually March and the wet season from November to April. The dry season is from May to October although there is really not a month with less than 0.9 inches of rain at Durban, 0.5 at Lourenco Marques, and 0.6 at Beira. The length of the rainy season is longer in Durban than in Lourenco Marques and there is not as marked a dry season. The annual rainfall at Beira is about 56 inches, at Durban 45, and at Lourenco Marques 30 inches.

Temperatures are never low. They range from 41 to 111 degrees F. at Durban, from 46 to 112 degrees F. at Lourenco Marques, and from 48 to 108 degrees F. at Beira. Inland temperatures would have a somewhat greater range.

Soils, variable as to origin and texture, are red loams, sands, and alluvial deposits. On the whole, they are placed among the red loams. The red loams are deficient in lime and are as a rule low in potash and phosphorus. Along the coast the soils are often sandy. There are also glei soils, usually dark in color, often containing lime, which are relatively productive. In addition, there is a great amount of alluvial soil more productive than the older and better-developed red loams. Many of these soils are dark or chocolate color and look much like some of our rich prairie soils. In fact, the alluvial soils along the Limpopo and Zambezi are unusually productive.

Fauna.—The fauna of this region was and still is rich in large game animals and some of the best hunting areas are found here. Buffalo are abundant along the Limpopo, and elephant and lion are common over much of the area. Kruger National Park lies at the edge of this area. Here are found wildebeest, waterbuck, zebra, impala, warthog, kudu, eland, nyala, elephant, hippopotamus, giraffe, sable antelope, roan antelope, steenbok, duiker, tsesebe, bushbuck, reedbuck, klipspringer, lion, leopard, cheetah, hunting dog, hyenas, jackals, civets, and a large population of birds and small game.

Peoples.—The peoples are of the Bantu group, such as Banyai, Batonga,

Bathonga, Anyanja, Zulu, and Xosa. They are chiefly crop growers but many cattle and sheep and goats are also kept. There has been a strong Asiatic infiltration into the coast cities of this area but by no means as noticeable as it is farther north.

Natural products.—This is a very rich area. A heavy population of wild animals provides the native with meat, skins, and ivory as an export product. Cattle, sheep, and goats subsist largely on the natural plant cover. Timber from the savanna and forests is important. It includes such trees as Cape box (*Buxus macowani*), sneezewood, (*Ptaeroxylon utile*), saffron (*Elaeodendron croceum*), Kafir plum (*Harpephyllum caffrum*), white ironwood (*Toddalia lanceolata*), Cape mahogany (*Trichilia emetica*), umzimbeet (*Millettia caffra*), hard pear (*Strychnos henningsii*), Cape ebony (*Heywoodia lucens*), African blackwood (*Dalbergia melanoxylon*), aligna (*Afzelia africana*), and mlombwa (*Pterocarpus angolensis*) which produces gum kino and a valuable cabinet wood. Ironwood (*Swartzia madagascariensis*) is a very hard dark wood used for furniture and for spindlewood; treba (*Andradia arborea*), a large timber tree, sandalwood (*Excoecaria africana*), and Cicuswa (*Lonchocarpus mossambicensis*), valuable and very hard woods suitable for furniture, and abura (*Mitragyna stypulosa*), a very hard, teak-like wood. Baobab (*Adansonia digitata*) is used for bark, fiber, the fruit and leaves as food. Bombax (*Bombax reflexum*), a large tree, produces a very light and soft wood. The region is rich in timber trees but the stand is usually open and there are not many trees of one kind per acre. There are a large number of valuable fiber plants. Much of the bark cloth made by pounding and cleaning the cambium portion of the bark is made from fig (*Ficus utilis*), okwein (*Brachystegia spicaeformis*), and other species. Sansevieria and the so-called wild banana (*Strelitzia augusta*) both furnish valuable fiber. As cordage the native can always place his hand on a bush or tree that will furnish a strong bark torn in strips to bind up any package. Here are whole groups of plants such as the mallows, sterculias, and legumes, almost all of which are suitable for such uses. Urera tenax furnishes a valuable fiber, and hyphaene and borassus palms furnish fiber in their leaves for many uses.

Rubber is relatively abundant, the most valuable plant being *Landolphia kirkii*, although several other species are found. It varies from an almost shrubby plant to an enormous vine reaching to the top of tall forest trees, with a vine diameter of 10 to 12 inches. The natives collect the latex by slashing off pieces of bark from the long vines which hang from the tops of the trees. This has proved a great natural resource, especially valuable before the extensive expansion of plantation rubber. There still is a great opportunity to develop Landolphia rubber under nearly natural conditions in much of this region. A number of figs and Euphorbias yield latex of value for rubber.

Oils are of great importance. Here *Trichilia emetica* is the most important oil plant. Its oil is used by natives both for rubbing on their bodies and for food. The oil is extracted by soaking the seeds in hot or cold water and the oil pressed out. Both the oil and the residue are used for food. These trees have been protected by the natives. *Telfairia pedata*, a large vine, produces a gourd-like fruit filled with large almost macaroon-like seeds which are rich in edible oil said to equal 60 per cent of the weight of the seed. Ricinus is abundant and there are many other oil plants.

Fruits are abundant. Carissa (*C.*

edulis and other species) produces edible fruit and is often cultivated, although it grows naturally throughout the area. Kafir orange (*Strychnos spinosa* and several other species) grows abundantly and has a fruit the size of an orange with a hard rind and an acidulous edible pulp. Morula (*Sclerocarya caffra*) produces an edible oilnut and edible pulp. Munkonongo (*Garcinia livingstonei*) is abundant in this region and produces an edible acid fruit which has been introduced and is growing in Florida. *Mimusops marginata* is valued as a fruit by the natives. Another native tree, Anona (*A. chrysophylla*), produces an edible fruit. There are many other native fruit trees and many exotic fruit trees have here established themselves. Among the more important of these are the mango, cashew, tamarind, orange, custard apples, breadfruit, and rose apples.

Native agriculture.—In this area almost any crop can be grown which can stand a temperature as low as 40 degrees F. and does not require a dry atmosphere. Small grains are probably shut out partly by the humid condition and a lack of dry weather to ripen the crop. Native peoples use a mixed or varied culture. Maize is important and can be grown with any other crops. There are relatively large acreages of maize on the richer bottomlands in this region. Rice is especially important in the lower country. It is not only prized by the natives as a food but is in demand by the Asiatics who live in the area. Manioc is an ideal crop since once started it can produce food from leaves and roots for some years without replanting. In the early stages it can be interplanted with maize, millet, sorghum, groundnuts, sweet potatoes, beans, and rice. Sorghum is also an important crop used both for food and to make an alcoholic drink. Groundnuts furnish a rich oil diet and are important. For money-crops the natives grow maize, groundnuts, and sesame. Many other foods are grown such as sweet potato, voandzeia, cowpea, beans, cucumber, melons, gourds, pumpkin, tomato, eggplant, ochra, chillies, and sugar cane. In winter, cool-weather crops such as cabbage and peas can be grown. Tobacco is grown for local use.

Fruits are used fresh and to make alcoholic drinks. This is especially true of cashew which has an edible fruit and a seed protected by an acid covering which has to be roasted to secure the edible nutmeat. It is this part which is exported.

European agriculture.—European agriculture is confined largely in Portuguese East Africa to sugar cane, maize, cotton, sisal, coconuts, and oil seeds. No very accurate figures are available but the acreage of maize in this region probably exceeds all other crops and amounts to about 344,000 acres. However, the wealth of this region rests on its adaptability to produce crops more exacting as to habitat than maize. Sugar cane on the rich alluvial lands and in the warm weather which prevails is an excellent crop. The total acreage is about 277,000, about 245,000 acres being in Natal. Bananas are produced on about 10,000 acres in Natal and principally for export. In Portuguese East Africa large numbers are grown and a part exported, but a large portion is consumed locally. Pineapples grow almost everywhere in this region and the fruit and base of the leaves are eaten and the leaves used as a source of fiber. The total acreage of pineapple is about 31,000 acres in Portuguese East Africa and probably less in Natal. Cotton in total acreage for this region amounts to about 33,000 acres, about equally divided between Natal and Portuguese East Africa. Sor-

FIGURE 285.—Gardens showing cabbage in foreground and coconut palms in the back. Beira, Portuguese East Africa.

ghum and millet are important but only about 10,000 acres are recorded in Natal. About 13,000 acres of groundnuts are grown in Portuguese East Africa. These crops are much more important than acreage figures would indicate since they are largely native crops and these figures are all for European production. Sisal is a very important export crop in Portuguese East Africa where about 66,000 acres are recorded. Coconuts are of great importance where they grow, since they furnish fiber, building material, drink, food, and oil. There are about 150,000 acres in Portuguese East Africa (Figure 185) and about 10,000 acres in Natal.

Livestock.—Livestock is important in this area. Only rough estimates can be given. Cattle are the most numerous and number about 1,020,000 for the region. Of these Natal has about 789,000, of which about a third are owned by Europeans. Portuguese East Africa has about 231,000, of which about a tenth are European-owned.

Sheep and goats are less numerous, numbering about 773,000. Of these about 730,000 are in Natal and 43,000 in Portuguese East Africa. In Natal about 474,000 are sheep and 256,000 are goats, and in Portuguese East Africa 40,000 are goats and 3,000 sheep. Of the sheep in Natal, about 410,000 are European-owned and 64,000 native-owned. Of the goats in Natal about 8,000 are European-owned and 248,000 native-owned. In Portuguese East Africa natives own about 2,000 sheep and Europeans 1,000. Natives own 34,000 and Europeans about 6,000 of the goats in Portuguese East Africa. The total of cattle and sheep and goats in this region amounts to 16 animal units per square mile of the total area.

Crops for export.—Sugar exceeds all other exports from this region and probably amounts to around $14,000,000. Sisal is also important. The exports amount to around 12,000 to 25,000 tons yearly. Copra probably amounts to 30,000 tons a year. Other exports of value are bananas, maize, oranges and fresh fruits, manioc, and beans. Produce is sent from this region inland to supply the markets of the Rhodesias, Transvaal, Orange Free State, and the Cape. Winter crops of vegetables such as cabbage (Figure 285) and tomato, and fruits such as banana, mango, pineapple, and coconut (Figure 286) are sent inland. They would not be recorded as export crops if they came from the Natal portion of this region.

Land under cultivation.—The total

FIGURE 286.—Coconuts, pineapples, bananas, and subtropical crops are grown. Beira, Portuguese East Africa.

recorded acreage under cultivation is about 775,000 or about nine per cent of the area. However, the record is by no means a measure of the total and if correction is made a rough estimate would give about 1,400,000 acres of land in crops or nearly 17 per cent of the whole area.

Potentialities.—Here is a region of exceptional promise. It can produce coconuts (copra), bananas, and sugar cane better than any other portion of South Africa. To these might be added pineapple, although this crop has been commercialized principally in eastern Cape Province. However, it grows almost naturally throughout this whole region and its production could be tremendously extended. Sisal grows well here but is by no means confined to this region. The development of semitropical fruits such as mango, avocado, cashew, papaya, the anonas, banana, and pineapple could be greatly extended. It can also supply during winter fresh vegetables such as tomato, cabbage, brussels sprouts, artichoke, and almost any desirable crop which cannot be grown during this period on the high plateau lands. Sugar cane, coconut, and banana should be outstanding and these can be supplemented by any warm-weather crops except such truly tropical crops as oil palm and cacao. Rice, maize, sorghum, groundnuts, sisal, fruits and vegetables, oil and fiber plants of many sorts can be grown.

13. CLOVES, COCONUTS, AND BANANAS

(*See* 4 on the map)

This area extends along the east coast of Africa from the southern part of Italian Somaliland south across Kenya and Tanganyika and into Portuguese East Africa to a point about 200 miles north of the mouth of the Zambezi River. It lies along the coast and below the 1,000-foot contour and includes the islands of Zanzibar and Pemba. The total area is about 50,000 square miles.

Natural vegetation.—The vegetation of Zanzibar and Pemba and of practically this whole coastal strip is Acacia–tall grass savanna. In sandy and drier places a luxuriant phase of thorn forest is found. At times also a forest very similar to the tropical rain forest develops in favored locations. In Zanzibar a large part of the island is rocky with a very shallow soil and a grass and brush plant cover not well suited to agriculture.

Rainfall, temperature, and soils.—Rainfall varies from as low as 30 inches to as high as 80 inches. It is 47 inches in Mombasa and 77 inches in Zanzibar. February and March have the least rainfall and April and May the heaviest. In southern Tanganyika and northern Portuguese East Africa the rainfall is lower, and June to October is the dry period. Temperatures are never low and never very high. At Mombasa the range is from 67 to 96 degrees F. On the whole, it is hot and humid but more comfortable during the drier part of the year.

The soils are for the most part of the red loam group, although they tend to the chernozem in the drier portion of the region. Much of the coast strip is a sand, with black or grey silt or clay soils in the bottoms and red loams on the highlands. The more sandy red soils are on the lower ridges and are preferred for sisal growing. Zanzibar and Pemba have soils derived from limestones and vary from sand to clay. The

sandy red earth in north central Zanzibar and western Pemba is planted largely to cloves. With these are mottled clays also planted to cloves. In south and east and north Zanzibar and a small portion of Pemba the soil is limited to pockets in the coral limestone. These are grass and brush areas and are used mostly for grazing except near villages where the small patches are used to grow vegetables. West central Zanzibar and a strip almost the whole length of Pemba near the east coast is loose sand and produces coconuts and food crops.

Fauna.—In Zanzibar and Pemba the larger animals disappeared long ago. They still have the Zanzibar leopard and a couple of species of mongoose. The mainland is still a big game country. Here baboons, monkeys and apes, duikers, hartebeest, bushbuck, lion, leopard, cheetah, hyenas, jackals, elephant, buffalo, gazelle, waterbuck, bush pig, oryx, giraffe, hippopotamus, rhinoceros, and crocodile are often abundant. In fact, this region has a fauna similar to the manioc, millet region which it touches only in the tropical portion.

Peoples.—The inhabitants of this east coast strip of Africa are probably more mixed than in any other part of Africa. In Zanzibar and Pemba, for example, the census of 1931 gave about 278 Europeans, 14,000 British Indians, 33,000 Arabs, and about 186,000 natives who represent about 70 different African tribes. The natives along the coast are also greatly mixed by migrations from the back country.

The most important of the mainland tribes in the economic life of Zanzibar are the Akamba, Wanyamwezi, and Kikuyu, and, to a lesser extent, the Makua and Wayao.

Zanzibar has for hundreds of years been the port of entry and port of exit for East Africa. Zanzibar merchants traded in gold, ivory, and slaves with the interior of Africa. An old Arab proverb says: "If you play your flute at Zanzibar, all Africa as far as the lakes dances." This was certainly true during the last century. Swahili is the language of Zanzibar, of the East Coast, and much of central Africa. Trade is even now very important, and the harbor of Zanzibar is filled with Arab dhows and European steamers. In 1929, 3,215 British and 221 foreign dhows entered with a combined tonnage of 76,000. In the same year, 469 British and 218 foreign vessels entered the harbor with a combined tonnage of 1,560,000, of which 288,000 went to Britain, 256,000 to Germany, 200,000 to the Union of South Africa, 122,000 to France, 117,000 to Portuguese East Africa, 113,000 to India and 49,000 to the United States.

Natural production.—The scattered forest and savanna trees of this region are valuable for timber, wood, fruits, fiber, and rubber. Here are many species of Landolphia, valuable for rubber and for fruits. Copal is an important natural product. The Zanzibar copal (*Trachylobium verrucosum*) produces the fresh copal and also produced the fossil copal which is much more valuable. Apparently this tree was once abundant in Zanzibar, and left in the soil a great quantity of fossil copal.

The more valuable timber trees are aligna, iroko, several Albizzeas and Acacias, msandarusi (*Trachylobium verrucosum*), okwein, locally called mriti (*Brachystegia speciformis*), and muhugu (*Brachylaena hutchinsii*). Muhugu is the largest of the composites and produces large logs and a strong, durable timber for construction work. Many of these trees produce fine cabinet woods.

Palms are relatively important and here are produced the borassus, doum, raphia, and wild date palm, valuable for wood, fiber, fruit, and vegetable ivory.

Many fruit trees grow here which were

discussed under the tropical fruits region such as morula, munkonongo, inchange, mpinji, makusu, custard apples, Kafir oranges, wild plum, jujube, grey plum, and also malulu, muhamane, carissa, munkonongo, and the following which are practically native: mango, cashew, tamarind, orange, custard apples, breadfruit, jack fruit, and rose apples. Casuarina or beef wood, a valuable timber tree, grows almost everywhere. Here are found practically all of the trees listed in the manioc region, the sorghum region, and the sugar cane region. Fiber plants such as raphia, coconut, sansevieria, brachystegia, and baobab are abundant. Palms are extensively used in the making of matting, rope, and baskets.

Food crops.—Manioc (Figure 287) is a staple food crop in Zanzibar and on the east coast of Africa. Other important crops are maize, rice, sesame, sorghum, pennisetum, eleusine, Colocasia, sweet potato, yam, ochra, tomato, cucumber, pigeon pea, lentil, turmeric, and amaranthus for greens.

Coconut is one of the chief foods, since it furnishes milk, the fresh meat of the nut, and the latter dried as copra. Other important foods are banana, pineapple, mango, jack fruit, breadfruit, durian, rambutan (*Nephelium lappaceum*), orange, tangerine, pomelo, lime, lemon, guava, rose apple, Terminalia catappa, papaya, wild mango (*Sorindeia*), avocado, and Eugenia cumini (Figure 173).

FIGURE 287.—Manioc is an important food crop in the clove and coconut region. Manioc is here grown on ridges. Bubulu, Zanzibar.

Betel nut (*Areca catechu*) is grown and extensively chewed. The nut is sliced and combined with dry and powdered tobacco, lime, and gambier, and folded in a betel pepper leaf to form the quid (Figure 288). The betel pepper (*Piper betle*) and gambier (*Uncaria gambir*) are also extensively grown. A clove is often used as a pin to hold the leaf about the other ingredients of the quid. The bloodlike saliva of those who chew betel nut makes the habit even more evident than tobacco chewing.

The betel, coconut, raphia, borassus, doum, and wild date palms are prominent and important for food, fiber (Figure 172), and building material. The oil palm also can be grown here.

An outstanding tree in Zanzibar and Pemba is the clove (*Eugenia aromatica*). These two islands produce four-fifths of the world clove supply. The trees must not be planted too close, about 60 to 90 per acre, since they need sun and air. They are handsome tall trees, shaped like pear trees and about 40 feet high (Figure 44). The flower buds are picked and dried to produce the clove of commerce. The fruits of buds missed in picking and young stems are used to produce clove oil. The whole island and the city of Zanzibar has the odor of cloves. They are not generally grown on the mainland but are grown extensively in eastern Madagascar.

Livestock.—Livestock is not relatively important in this region. Sheep and goats are the most numerous; the estimate places the number at about 916,000 about equally divided between goats and sheep. This is about 18 per square mile. Tanganyika has about 840,000, Zanzibar

27,000, and Kenya 50,000. Cattle are not as numerous but are probably more important (Figure 219). They total about 180,000, or about 3.6 per square mile. About 100,000 are in Tanganyika and 28,000 in Zanzibar. Donkeys used as beasts of burden number about 14,000, of which about 10,000 are in Tanganyika and 4,000 in Zanzibar. Cattle are often used as draft animals. The total animal population expressed in animal units is less than six per square mile.

Crop production.—For the region as a whole, sorghum and millets occupy about 500,000 acres. Maize is grown on 340,000 acres. Cotton shows an acreage of about 36,000, and manioc 34,000. Coconut (Figure 55) is a very important crop, the total for the region being about 140,000 acres. About 55,000 acres are in Zanzibar, 40,000 in Tanganyika, 28,000 in Kenya, and 15,000 acres on the coast of Portuguese East Africa.

Cloves are confined almost entirely to Zanzibar and Pemba where there are about 48,000 acres.

The total recorded acreage under crop in this region is about 1,000,000. It is probable, however, that 1,800,000 acres or about 5.6 per cent of the available land would be a fair estimate of the acreage under crop.

Cloves and clove oil are the most valuable exports from this region, totaling about $4,300,000 in 1929. The yearly export value varies with the market. Copra also ranks high as an export crop, totaling about $1,800,000 (Figure 289). These are the principal exports. However, sisal, cotton, copal, beeswax, sesame, maize, sorghum, and millet are produced in quantity.

Potentialities.—Cloves, copra, bananas, mangoes, and other tropical fruits can be produced here as well, if not better, than in any part of Africa. Fruits which require tropical conditions throughout the year, but which can withstand a few dry days, should thrive. A few of the fruits are mango, coconut, banana, pineapple, jack fruit, breadfruit, rambutan, citrus, guava, rose apples, papaya, and avocado. Sesame, cotton, maize, sisal, and manioc are important, and here can also be grown any but the cool-weather crops and those that cannot withstand sun and wind. This region has been rather fully developed and should rank next to the date palm region in making good use of its natural renewable resources.

FIGURE 288.—Betel nuts, sliced and ready for sale, are shown in the center and back; betel pepper leaves tied up in small bundles at the right. Gambier at left in the rear. Tobacco, dry and powdered, is in the tray at the right, and lime above the tray. These combine to form the betel quid. In the market at Zanzibar.

FIGURE 289.—Cloves and coconuts are the chief crops of Zanzibar. Here the fruit of the coconut is being dried to produce copra for market. Zanzibar.

14. DATE PALM, FRUITS, VEGETABLES, CEREALS, AND COTTON REGION

(*See* 7 on the map)

This is irrigated or subirrigated land in a hot, dry desert region. The word oasis is applied to small isolated areas and also to the Nile Valley. Originally the Nile Valley was watered naturally by the flood waters of the Nile River and water drained off the land when the floods subsided. The advantage of the natural system over one of controlled irrigation is that there was no accumulation of harmful salts in the soil to cause it to deteriorate in fertility and tilth. Now the water controlled by dams and irrigation (Figure 290) is used when and to the amount desired.

The Niger River rises near the Guinea Coast and flows northeast into the desert. It probably spread out in the Sahara north of the Niger bend until an outlet developed to the southeast which now drains off this water to the Gulf of Guinea. The Shari River pours an immense amount of water into the Chad basin where it would probably form an oasis were it not too close to the humid belt. However, this water probably continues into the desert and feeds the fertile lands of Borku which lie northeast and 300 feet below the level of Lake Chad. These lands were at one time a part of Lake Chad according to Tilho. (Tilho, Jean. *Documents Scientific de la mission Tilho.* Vol. 1–3. Paris, 1911.) Farther east the Nile forms the great swamp at the Bahr el Ghazal and Lake No, but the waters break out and, supplemented by the rivers from Ethiopia, flow across the desert (Figure 291) to form the great irrigated Nile Valley.

On the desert side of the Atlas Mountains there are a similar number of smaller streams or rivers which spread out in the shotts or are lost underground. Where these waters are carried far out into the desert they form true oases.

The principal oases other than the Nile Valley are Borku, fed naturally by underground waters, probably from the Shari River through Lake Chad and from the wadis of Tibesti, Kufara, with an abundant water supply which may come from these same highlands, and Fezzan, where lakes provide an easy means of carrying water over desert lands.

Most of the other oases, however, do not have a free flow of abundant water and many are merely the result of accumulated waters, either flooded together by wadis or accumulated under masses of sandhills known as ergs. Such are the Algerian oases, some of which are fed from the Atlas Mountains. A string sometimes referred to as "The Street of Palms" extends from Figuig in Morocco to the Ahaggar foothills in Algeria, a distance of 745 miles. Without exception, these have been developed by underground aqueducts known as foggaras and mark a geological contact between ancient rock and a Cretaceous and Tertiary plateau which gathers the water to feed these oases. (Gautier, E. F. *Le Sahara.* Paris, 1928.)

The Egyptian oases Kharga, Dakhla, Farafra, and Baharia in the Libyan Desert are all supplied by subterranean hot or warm water and have no relation to surface drainage channels. They are supplemented by wells or foggaras similar to, but much better made than those of the western Sahara.

Fezzan in Algeria is one of the largest and best developed areas in the whole Sahara. This name is used to include the oases from Sokna in the north to

FIGURE 290.—An irrigation canal with many simple waterwheels for irrigating the adjacent lands. Camels and oxen are used to turn the wheels, typical of many portions of the lower Nile Valley. Luxor, Egypt.

Tummo in the south. They all have excellent water supplies.

The word "oasis" is of Coptic origin and means "inhabited place," and is used by geographers and Europeans but is not used locally. Water determines the location of inhabited places which are usually marked by forests of date palms. On the basis of water supply, they differ markedly.

The Nile Valley was originally irrigated naturally by the Nile in flood. This is still true to a certain extent but most of the water is now controlled and irrigation takes place either by gravity or by raising the water by devices such as the chadouf (Figures 292 and 293) or other simple means (Figures 4 and 290).

Flowing from the Atlas Mountains are a number of rivers which sink into the desert or continue in intermittently wet or dry wadis such as Dra, Dades, Todra, Ziz, Guir, Bechar, Zousfana, Figuig, Biskra, and Sous.

Another group of oases are formed by springs and shallow wells such as those of the lower Sous and as Imiteq, Akka, Tissint, Tafilalet, Tarhit, Beni Abbes, Kerzaz, Laghouat, Tolga, Oumach, Ouled Djellal, Gafsa, Tozeur, Nefta, Djerba, Zouara, Tripoli, Homs, Sokna, Braak, Sebha, Rhat, and El Oubari, Mourzouk and Trarhene in Fezzan, and the important isolated oasis of Kufara in Libya, and Siwa in Egypt. Artesian wells are developed in Figuig, El Golea, In Salah, Ghardaia, Tolga, Ourir, Mraier, Ourlhaha, Djama, Tamerna, Touggourt, Blidet Amor, Ouargla, Kebili, Nefzaoua, Sinaoun, Derdj, and Rhadames (Ghadames). Deep wells are used in Berriane, Ghardaia, Metlili, and Guerrara. Many of these use camels and donkeys to raise the water by means of a dillus, a long-handled leather bucket. Souf is irrigated by a water sheet near the surface and the same is true to quite

FIGURE 291.—The sand desert comes to the banks of the Nile with a few Tamarix at the river bank. Between Wadi Halfa and Deer, Egypt.

an extent of Borku. Many oases are developed by underground reservoirs and aqueducts known as foggaras such as in parts of Sous and Tafilalet but more especially in Gourara, Touat, and Tidilet in such oases as Tabelkosa, Timimoun, Charouine, Igosten, Adrar, Tamentit, Aoulef, In Rhar, and In Salah, and in the Libyan Desert of Egypt in Kharga, Dakhla, Farafra, and Baharia. (See Bernard, Augustin. *Afrique Septentrionale et Occidentale, Geographie Universelle, Tome IX*. Paris, 1939.)

Southwest Africa has irrigated areas which are physically similar to the oases of the north but are largely under European occupancy. Here date palms, figs, cotton, oranges, citron, and many other crops of the oasis region are grown.

The natural vegetation of the oases was largely trees such as the date palm, doum palm, Acacia arabica, Acacia albida, figs, Ziziphus spina Christi, Tamarix articulata, Tamarix gallica, and a great number of coarse water plants such as Phragmites, Typha, Scirpus, and Juncus.

Rainfall, temperature, and soil—Rainfall is of little or no significance except in so far as it furnishes water to wadis and ergs. Torrential rains often do great damage to dwellings and gardens. In fact, rainfall is decidedly detrimental to the production of such crops as dates and melons since fruits of superior quality are ripened without it. Dates will crack open and ferment if water falls on the nearly ripe fruit and cantaloupes lose their flavor quickly if wet by rain. Practically this whole area is rainless throughout much of the period when dates are ripening.

FIGURE 292.—A chadouf used in raising water for irrigation. The bucket is balanced by a weight at the other end of the lever. Luxor, Egypt.

The mean annual rainfall at In Salah in Algeria is 0.12 inches and at El Golea 1.69 inches. Wadi Halfa in the Anglo-Egyptian Sudan and Aswan in Egypt have no recorded annual rainfall. Cairo has 1.27 inches. Precipitation is negligible in this region. However, there is probably no region in the world where so much water is required by each plant grown, since water is lost to the air by transpiration at a rate proportional to the radiant energy received by the plant and the dryness of the air. Plants are entirely dependent on ground or irrigation water.

Frosts are rare but high summer temperatures are the rule. Temperatures range from 25 to 133 degrees F. in In Salah, from 36 to 124 degrees F. in Aswan, and from 31 to 113 degrees F. in Cairo.

The soils are mostly alluvial silts, rich in nutrients and organic matter. They have not remained in place long enough to present definite profile structures. In many places eolian sand and silt is being continually added and the soils are from 60 to 75 per cent sand and from 16 to 25 per cent clay. On the whole they are fertile and under irrigation have a tendency to become saline.

Fauna.—The original fauna has been largely extirpated during the long period of occupancy by man. The hippopotamus, wild cattle, wild boar, and crocodile are no longer found in the Nile Valley. There still remains a rich bird

fauna and a few animals such as the hyena, jackal, red fox, hares, jeroba, polecat, weasel, mongoose, wildcat, and porcupine. The desert isabelline, eritrean and kordofan gazelles, the addax and the white oryx occupy the adjacent desert. Fish are important in the Nile River.

Peoples.—In Egypt over 90 per cent of the people are Moslems and about seven per cent are Copts. In the oases, generally the sedentary crop-growing peoples are Negroid and related to the Sudanese. Here malaria has favored the Berber group over the Arabic nomads.

FIGURE 293.—An irrigation canal with many chadoufs used to raise water over the bank to the agricultural land beyond. Cairo, Egypt.

Crop production.—Crops may be divided into annual crops and perennial crops. In the latter, the date (Figure 13) would certainly take first place. It is grown throughout the area and most of the oases appear as a solid or nearly solid stand of date palms. These produce food for local consumption and also for export. Both sweet and dry varieties are grown. Besides the date, doum palm, apricot, pomegranate, fig, jujube, grape, orange, lemon, lime, citron, Acacias for gum, banana, apple, peach, almond, pear, plum, tamarind, pistachio, guava, and many other trees are grown. These are all useful and fill a place in the economy of the area.

The land is fully occupied by crops most of the year. In winter a great many crops are grown, among which are wheat, barley, oats, flax, garden pea, lentil, onion, celery, asparagus, sugar beet, chard, cabbage, cauliflower, kohlrabi, brussels sprouts, turnip, chicory, endive, artichoke, carrot, parsnip, lupines, lettuce, cress, vetch, tomato, beans, opium poppy, spinach, chick pea, broad bean, fenugreek, and many other crops.

The principal summer crops are cotton, maize, cowpea, ochra, broom corn, sorghum, sugar cane, alfalfa, Johnson grass, rice, simsim, eggplant, tomato, henna, sweet potato, indigo, Jerusalem artichoke, teosinte, squash, gourd, pumpkin, melons, cucumber, watermelon, Colocasia, red and sweet peppers, pigeon pea, soy bean, sugar beet, groundnuts, and similar crops. Where flood-water irrigation occurs, maize and rice are

grown, chiefly just following the flooding, and beans also are planted as the water recedes.

The amount of land in the principal crops can be only roughly estimated. Even on the ground this would be difficult since in much of the area orchards are interplanted and several crops are grown on the same land in a year. A true estimate would possibly double the actual acreage under cultivation if it included an acreage for dates, citrus and deciduous fruits, and likewise for cereals and other annual crops. This is true in Egypt as well as in the isolated oases. On the basis of records, maize occupies 2,131,000 acres. Cotton is next with 1,805,000 acres, followed by small grains of which wheat occupies 1,590,000 acres and barley 366,000 acres. Beans have an acreage of 531,000 and rice 268,000. Sorghums and millets are important, probably totaling 300,000 acres, sugar cane 70,000, lentils 80,000, and onions 30,000. Alfalfa is an important forage crop.

For the area as a whole, dates are planted everywhere and in the oases push out into the ergs where they can reach subsoil water. Olives, oranges, figs, almonds, apricots, peaches, grapes, jujubes, apples, pistachio, pomegranates, citron, lemons, limes, and similar fruits are grown and under these, annual crops are planted.

Animal production.—Although almost all of the land in this region is irrigated and valuable for crop production, the animal production is relatively high. Only rough estimates can be made for the isolated areas. Cattle are the most numerous and number about 1,521,000, all but a few thousand being in Egypt. About half of these are buffaloes. Sheep and goats number about 2,368,000, the goats exceeding the sheep in number. Donkeys number about 750,000, camels 281,000, horses 38,000, mules 21,000, and pigs 21,000. On the basis of animal units the total is 3,089,000 or about 86 per square mile, or if limited to cultivated land it would amount to about 287 per square mile. In this region, especially in the oases such as Borku, there are large areas of subirrigated meadow land used largely by livestock. Therefore, the animals are not entirely concentrated on the cultivated lands.

The camel is best adjusted to use for transport. Not only can it carry a heavy load but can travel from oasis to oasis for eight to ten days without a drink. This makes it invaluable as a desert animal. The dromedary which has a single hump (Figure 66), is the type used in the desert.

Dogs are said to be absent in most of the oases. This is due largely to the fact that here they are not eaten by man and they consume too much food in a region where food is scarce and where water must be measured drop by drop. Flies are generally a pest and malaria common.

The agricultural methods used in the Nile Valley and the other oases may appear crude and primitive in a mechanistic world. Still they have been practiced for 5,000 years and have fully met the requirements of a dense population. Water is raised by hand with chadouf (Figure 292) or Archimedes screw, and by simple waterwheel (Figure 4) or dillus, operated by camel or ox. The land is plowed (Figure 8) and carefully prepared for planting and irrigation (Figure 2) and placed in excellent tilth. Heavy crops (Figure 220) are produced and every effort is made to fully utilize the land (Figure 294) throughout the whole year and to utilize fully the products of the soil (Figure 162).

Crops for export.—The principal export production of this region is cotton which exceeds all other agricultural products combined and amounts to

almost $150,000,000 a year. Vegetable products such as onions, rice, and maize are next, amounting to about $2,400,000 a year. For the region as a whole, dates are important, especially from Algeria and Tunis, and may total half a million dollars a year. A great amount of the vegetables and fruits produced are consumed locally. Animal and vegetable fats are exported.

Crop potentialities.—Probably no portion of the earth's surface has so nearly reached its potential capacity for production as has this region. The productive capacity is indicated by the dense population, about 1,400 per square mile; the high value of the agricultural exports, $26,000 per square mile, and by the tax raised by the government, $2,900 per square mile of agricultural land. These figures for Egypt would indicate a region which has gone far in realizing the productive capacity of the land. In all probability the resources of the oases of the Sahara are equally well used for human benefit although much of their produce is locally consumed or traded to the nomads who rely on these areas for a large part of their livelihood and who usually dictate the conditions of trade. This area is so highly productive that it is difficult to compare it with any other (see Table A, page 231, and Table B, page 235).

FIGURE 294.—Throughout the year the oases and the Nile Valley produce continuously. Here are shown goats, sheep, water buffalo, and cattle. Also land being prepared for crops of sorghum, sugar cane, ochra, dates, and cotton. Luxor, Egypt.

The difficulties of all irrigated areas are here important and to continue this productive capacity, means must be provided to prevent the accumulation of excessive amounts of salts in the irrigated lands. Along the Nile, flooding is possible and will rapidly remove accumulated alkali but in the oasis the problem of avoiding too great an accumulation of salt is more difficult. In most of the oases sand and silt are being added by wind action and occasionally by torrential rains which cause floods, thus adding new soil relatively free of salts.

15. MANGROVE BARK AND TIMBER REGION

(*See* 16 on the map)

This area is confined to the swamps in salt or brackish water and extends from the Red Sea to Natal on the east coast and on the west coast from Senegambia to Angola. The greater areas and the larger trees are in West Africa but bark is more easily cured and the local demand for timber is greater in East Africa. The west coast of Madagascar has many areas of mangrove. There are probably about 19,000 square miles of the type.

In Portuguese Guinea there are about 5,000 square miles of mangrove forest, 2,000 in French Equatorial Africa, 2,000 in Nigeria, and 2,000 in Sierra Leone. Smaller areas of about 1,000 square miles are found in Kenya, Tanganyika, Portuguese East Africa, Madagascar, French Cameroons, British Cameroons, French Guinea, Gambia, and Senegal. Small areas are found in Zanzibar, Spanish Guinea, Dahomey, Gold Coast, and Liberia.

The vegetation is a tangle of knees and roots of trees which thrive in brackish water. The trees are from 25 to 75 feet high, usually standing high on prop roots. In this waterlogged saline mud, trees are rapidly replaced when cut. The bark yields about 30 per cent of tannin and is highly prized for this purpose. The stems and trees are especially valuable for use in salt water and find a ready market. In East Africa the bark can be dried for market; in West Africa this is more difficult. The value of this type lies almost entirely in tanbark and mussel-resistant timber. No adequate evaluation of this resource can be given. The bark is usually shipped to Europe and America, and at one time Mozambique exported as much as 4,000 tons annually. Kenya and Tanganyika export annually half a million mangrove poles (*Boriti*) to Arabia and India. Tanganyika exported bark valued at from 6,000 to 12,000 pounds sterling yearly from 1933 to 1936 and over 1,000 pounds sterling of poles. Mangrove is used for wood after the bark is removed (Figure 295).

FIGURE 295.—Mangrove bark is stripped off and dried for the European market. The wood is then cut and sold for firewood. The longer poles are sold as boriti and shipped to Arabia and India. The man in the fore is operating a scales since wood is sold by weight. Zanzibar.

The principal timber trees are mangrove (*Rhizophora mangle*), false mangrove (*Lagunculariа racemosa*), and Pagatpat (*Sonneratia caseolaris*). In Tanganyika most of the bark and poles are from *Bruguiera gymnorrhiza* and *Rhizophora mucronata*. Mangrove grows in brackish organic mud and ooze and by dropping seedlings already developed on the parent trees can readily advance over available areas (Figure 100). The roots are covered with algae and marine mollusks, crustaceans, and other invertebrates. Intensive use of mangrove areas requires careful management to avoid destructive overuse and partial or total destruction of the resource.

16. WILDLIFE

(*See* 15 on the map)

Of especial interest in Africa are the large swamp or marsh grass areas. In North Africa the waters of the Shari River spread out over a large area known as Lake Chad. At times it is a large lake and at drought periods it practically disappears. During periods of drought there may be great areas of dried mud flats. In wet years these may become areas of open water which rapidly close in with marsh grass, papyrus, and ambash. The north shore is semiarid while the south shore is in the humid area. The Niger River starts northeast from the Fouta-Djallon and flows into the desert and were it not that a drainage channel leads east and south to the Guinea coast would have produced at the bend of the Niger another settling and evaporation swamp or marsh similar to Lake Chad. As it is there are large areas of overflowed

marshlands at the bend of the Niger.

In the Nile basin the great amount of water collected from central Africa spreads out at and above Lake No to form one of the large marshlands of the world. Most of the water is lost there to the air by evaporation and by transpiration. Still a great amount pushes through and joins with the Sobat to flow on north as part of the Nile. The drainage from the west, combined with that of the White Nile, which alone at Mongalla averages 75 million cubic meters daily, shrinks to 27 million cubic meters daily below Lake No. In other words, 48 million cubic meters, plus practically the total flow of the Bahr el Ghazal, fed by about ten rivers which drain an area of over 100,000 square miles, are lost in this magnificent papyrus swamp. East of the White Nile, the Bahr El Zeraf and the rivers flowing north into the Sobat drain many swampy marsh grasslands. These great swamp areas hold back flood waters and equalize the flow of the White Nile. The floods of the lower Nile originate in the Ethiopian highlands. Had this marsh area been a little more arid or the amount of water a little less, another closed basin might have resulted. As it stands, it is the world's largest and one of the most widely known swamps. Days are spent on the steamer both going down and up the White Nile, and to those interested in biology there is a never-ending display of plant and animal life.

In South Africa, Lake Ngami, the Okovango swamp, and the flood and marshland in the Caprivi strip are similar to the Niger bend country in that they are almost but not quite land locked. Most of the other marsh grass areas are in a humid climate and do not fluctuate much as to level and size.

The largest of these marsh grass areas is that along the White Nile and Bahr el Ghazal, in the Anglo-Egyptian Sudan, which covers roughly 15,000 square miles. Lake Kioga and adjacent lakes and rivers in Uganda are listed as water areas but are largely sudd and papyrus, totaling about 12,000 square miles in area. Marsh areas at Lakes Bangweulu and Mweru in the Congo River drainage, at Lukanga swamp and along the Zambezi in Northern Rhodesia total about 10,000 square miles. Lakes Upemba and Kisali on the Lualaba, and many other river swamps in the Congo, total about 9,000 square miles. At times the marshlands of Lake Chad cover an area of about 6,000 square miles. In French Equatorial Africa there are about 3,000 square miles of marshland. In South Africa the marshlands of Lake Ngami, Okovango swamp and the Caprivi strip which varies greatly in area may be estimated at about 2,000 square miles. Portuguese East Africa has about 3,000 square miles; Nigeria, Urundi and Ruandi, Angola and the Territory of the Niger about 2,000 square miles each; and Madagascar, Bechuanaland, Southwest Africa, French Togo, Dahomey, Gold Coast, Ashanti and Northern Territories, and French Sudan 1,000 each. Marshes are also found in many places in central Africa.

The total area of swamp is approximately 60,000 square miles. To this can be added 67,000 square miles of water area which with the many rivers forms a very satisfactory area and distribution for the use of migratory water fowl. Most of the lakes and rivers have papyrus swamps at many places along the shores which are ideal for many forms of wildlife. The vegetation of these areas is predominantly papyrus (*Cyperus papyrus*) which forms areas of luxuriant growth reaching 20 feet in height (Figure 296). With papyrus are many other plants such as *Panicum maximum*, *Echinochloa pyramidalis*,

Sorghum arundinaceum, *Phragmites communis*, *Setaria aurea*, *Vossia procera*, *Polygonum senegalense*, *Ipomoea aquatica*, *Ipomoea palmata*, and *Luffa aegyptiaca*. Ambash (*Herminiera elaphroxylon*) is as striking as papyrus. It is a legume with brilliant yellow flowers and wood lighter than any other of equal size.

In the more open water, beautiful water lilies, water-lettuce, and other water plants are abundant (Figure 297). One of the difficulties of navigation on Lake Kioga, the Bahr el Ghazal, Lake No, and on other marsh areas is the sudd or floating vegetation which may completely close off the channels. Broken from the banks, this material behaves like ice floes and may pile up to a height of 20 feet above the water. This condition requires cutters and dredges to keep the channel open. In the narrow channels, steamers occasionally have to head into the bank at a sharp bend of the river and allow the stern to be carried around down the river; then as soon as a turn can be made the ship is again headed downstream.

FIGURE 296.—The luxuriant growth of papyrus makes these areas difficult to pass. Here a native man is making his way through a thick stand which towers to fifteen feet above his head. Between Nairobi and Fort Hall, Kenya.

Climatic conditions are not a determining factor. In fact, the largest swamps are often in semiarid regions while others are in a rain forest environment. Practically all of these swamps are alluvial areas where soil is continually silting in, and even where great rivers such as the Lualaba and Nile flow through, there is a tendency to form a natural silt levee (Figure 196). In many of the marshes in semiarid country like Lakes Chad and Ngami the receding water is followed by agriculturists who plant at the edge of this receding water to produce a crop. Often they extend this culture by wells or irrigation. It is true, therefore, that an area may be a lake of floating sudd at one time, become a field of sorghum during dry years and in turn, following flooding, an area of open water. The soils are unusually productive. In many places oil palm is grown and utilized by the natives. Papyrus is used extensively in hut building, and ambash is used extensively for rafts and also in hut building. Efforts have been made to utilize the great amount of papyrus. Many think it could be used to produce paper pulp. The Egyptians compressed the pith of papyrus to produce the paper on which they wrote their records. At one time it was tried as fuel in Nile steamers, but on combustion the silica fused and clogged the pipes in the engine boilers.

The peoples who occupy these areas are of widely different groups. At Lake Chad the Buduma who occupy the

islands were pirates in the earlier days. Along the edge of Lake Chad agriculturists predominate. In the Bahr el Ghazal the Nilotic peoples, especially the Nuer, live in this marshland part of the year. Even in the papyrus areas along the Lualaba, small land areas are inhabited and generally planted with maize (Figure 196). Often these lands are planted with rice, sorghum, eleusine, sweet potato, manioc, and vegetables of many kinds. Oil palm is important and banana, papaya, sugar cane, and many other plants are grown. Fish are always important and are seen dried almost everywhere for use at some future time. However, mammals are more important in these great marsh areas. They vary somewhat in different parts of the continent. In the Bahr el Ghazal and the Lorian swamp areas and similar places there are at times tremendous concentrations of big-game animals. In all of these marshes the hippopotamus is at home and is used for food by the natives wherever he can be killed; the hide is a marketable product. Nile steamers haul down great quantities of hippo hide (Figure 70), cut in strips, dried, and tied in bundles.

FIGURE 297.—Marsh grass areas in Africa are very extensive. This is a general view along the free water side showing papyrus twelve to fifteen feet high. Morning glories, water lilies, hibiscus, sagitaria, and ambash. These areas are teeming with wildlife. Lower end of Lake Kioga near Masindi Port, Uganda.

FIGURE 298.—In places where trees are scarce, open-billed storks and cormorants roost on the leaves of oil palms in such great numbers that the leaves are broken down by the weight of the birds. Uiongo, Belgian Congo.

The elephant seems to prefer these swamps and at times is found in great numbers, especially in the Lake Mweru and the Bahr el Ghazal country. Buffalo also are found in these marshes and are characteristic of this region. Other large animals found here are the tiang, lechwe, puku, Senga cob, Uganda cob, white-eared cob, Mrs. Gray's waterbuck, Vaughan's cob, reedbuck, Selous situtunga, and Speke situtunga. The last two are characterized by exceedingly long hoofs which enable them to walk over loose sudd-like marsh grass areas.

Two otters, one a clawed and one a clawless, are abundant in these marshes. The clawless otter is unusually large and each produces excellent fur, the nap being shorter than those of the north but glossy and durable. These are said to be present in great numbers in the Bangweulu area. They are also abundant along the Lualaba.

There are characteristic birds, chief of which is the whale-headed stork, found in the Bahr el Ghazal, Lake Victoria, and on the Lualaba. Oil palms on the

Lualaba are often broken down (Figure 298) by the great numbers of cormorants or open-billed storks perching on the leaves. Pelicans, spoonbills, spur-winged geese and pygmy geese, snake birds, hammerheads, fishing eagle, and many waterfowl are abundant in these marsh grass areas. There are also small birds which prefer papyrus for nesting sites and live largely in these areas. At times great areas of papyrus are white with the large flocks of white herons roosting on the tops of the plants.

The reptiles include the crocodile, monitor lizard, and many snakes. Fish are of prime importance to native peoples and at times they are taken in rather large quantity and dried for food. Lung fish are also dug from the drying mud when water recedes during periods of drought. A Nile perch was taken in Lake No weighing 280 pounds. Tiger fish vary from three to twenty pounds and kwara up to four pounds. There are many species of native fish in these waters.

Peoples are adapted to this great area and live largely on the natural products of fish and the flesh of mammals, birds, and reptiles.

NOTE: The following corrections in the text of the article are suggested by the author

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Page 124, Table IV, under totals, change "4,367,047" to read "44,367,047."
Page 130, Table V, under Guinea (Portuguese) column 5, change "152" to read "89."
Page 148, Table VII, under Southwest Africa, column 9, change "27" to read "2.7," and make necessary changes in Figures 97 and 98 and in the text on pages 159 and 160.
Page 149, Table VII, under Tunis, column 10, change "115" to "11.5," and make necessary changes in Figures 89 and 90 and in the text on page 155.

VOL. 16, NO. 4

Page 343, second column, lines 22 and 23, change "gwara" to read "guarea," and "nakore" to read "makore."
Page 364, Table VII-A, under Union of South Africa, column 6, change "44" to read "46" and "243" to read "247."

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Page 347 in Figure 241, change "Bishav'rn" to read "Bisharin," "Fanzi" to "Fanti," "Berberi" to "Beriberi," "Adanda" to "Abanda," "Momburo" to "Mombuto," "Mangberu" to "Mangbetu," "Dankil" to "Danakil," "Gallo" to "Galla," "Turhana" to "Turkana," "Warusi" to "Watusi," "Bafiori" to "Bafioti," "Wasanik" to "Wasania," "Amsmbwe" to "Amambwe," "Anyania" to "Anyanja," "Baronga" to "Batonga," "Mashone" to "Mashona," "Marabele" to "Matabele," "Barhonga" to "Bathonga."
Page 352, second column, 24th line. Change "sweet potatoes and yams. Nearer the equator and" to read "sweet potatoes and yams nearer the equator, and."
Page 355, first column, line 8, change "the east and the Tibbu in the west" to read "the west and the Tibbu in the east."

ECONOMIC CONTRIBUTIONS OF THE GREEKS TO THE UNITED STATES

Helen H. Balk

THE early Greek immigrant on his arrival in the United States was chiefly employed as an unskilled laborer in the textile industry of New England, a miner in Utah or Pennsylvania, a laborer on railroads all over the country, a fisherman on one coast or another, or farmhand on the fruit farms of California. In fact, he could find place in almost any occupation which required labor without much skill. When the laborer had saved a little money he invested it in a fruit or flower tray and peddled his wares in some city street. By virtue of long hours, thrifty living, and keen business sense he collected a little more money which he invested in a fruit or flower stand, and on the accumulation of a little more capital he started a small business. Perhaps several Greeks rented a property together to establish the variety store; confectionery goods, shoeshining and repairing, and the flower mart, all in one store. Trade in fruit, candy, and flowers can be started with small capital and little experience. The turnover is almost daily. Only small funds are tied up in the business at any one time, but they can gradually be expanded until profitable proportions are reached. Small businesses of this kind thus fitted with Greek plans, Greek capacity, and Greek enterprise.

Close coöperation among the Greeks in their economic life was one of the main factors which brought about the establishment of Greek communities, churches, and schools. The intimate circle formed from the first immigrants and those coming later may be traced to the fact that none could speak English on his arrival in this country, and those who came earlier were a little more familiar with the language and customs of the new country than later arrivals.

The church has always been an important element in the loyalty and unification of the Greeks, for almost all Greeks belong to the Greek Orthodox or Eastern Catholic Church. Through long centuries without an independent national territory the idea of nationalism was preserved by the Greek Church. Tradition of classical culture is a very important additional unifying factor. Any cultural attributes which an ethnic group possesses are maintained only if the number of members is large. When there is an insufficient number of people to organize a church, a fraternal or social organization, its cultural solidarity is more rarely achieved. Concentration of Greeks in cities is partly explained by the need of numbers for any social or other organization. Of the total number of Greeks in the United States, 91 per cent congregate in urban areas, 7.14 per cent reside in rural areas but do not farm, and only 1.6 per cent have settled on farms.

After 1890, the so-called "new" immigration into America took place, that is, the immigration of the peoples of southern and eastern Europe of which the Greeks were a conspicuous element. The "old" immigration into America was composed chiefly of western Europeans and the Greeks took only a very insignificant part in it.

Greeks usually engage in businesses

in which their compatriots have been successful but which are limited in potentialities for expansion within any one locality. As they prosper they scatter into smaller cities and towns in order to pursue the few businesses to which they confine themselves, which in turn gives rise to the characteristic feature of Greek immigration—its scattered nature.

Seldom do Greeks venture into fields where none of their compatriots have dared to venture. It is natural then that immigrants, ignorant of the language, customs, and laws of the new country, should start those businesses in which many of their personal friends have engaged. Many who come to this country are employed by friends already established in business, thus avoiding the early stages described. When they have saved enough money they start similar business enterprises on their own responsibility, for only in such a business have they had any experience. Thus they become scattered throughout the cities of the country because of the nature of their business. Individuals break away from the group in order to settle in the smaller towns and cities, so that, today almost all small towns have at least one Greek citizen or representative. Sometimes a Greek who has established himself in a business starts a branch of that business in another city and sends a compatriot to manage it. When the manager has saved sufficient funds he may buy the business and run it for himself.

The most conspicuous feature of early Greek immigration statistics is the preponderance of males over females. Among the foreign-born Greeks in the United States in 1910 the men numbered 93,447 and the women 7,835, indicating that they had come to earn money with intent to return to Greece for they did not bring their families with them. In the decade 1910–1920 the number of foreign-born males was still greater than females but the proportion was diminishing and by 1930 the following proportions had been reached:

	Total	*Foreign-born*	*Native White*
Male	195,192	129,101	66,091
Female	108,559	45,425	63,134

NATURALIZATION OF THE GREEKS

The number of naturalized Greeks has increased; not only because more Greeks have decided to come to the United States to establish their homes permanently here, but also because those who had come to the United States earlier have had time to become citizens. In 1910, out of a total of 74,975 Greek males over 21 who were eligible for citizenship, 58,208 were aliens. Only 4,946 or 6.6 per cent were naturalized citizens and 6.1 per cent had taken out their first papers.

In 1920, out of a total of 175,972, the naturalized Greeks numbered 29,479 or 16.8 per cent; 117,290 were aliens, and first papers had been taken out by 21,451.

In 1930, of the total number of foreign-born Greeks (174,526), only 65,977 were aliens. 78,059 or 44 per cent were naturalized and 25,112 had taken out their first papers; 59.1 per cent had registered a willingness to become citizens of the United States. It is evident that the number of Greeks who become citizens is increasing.

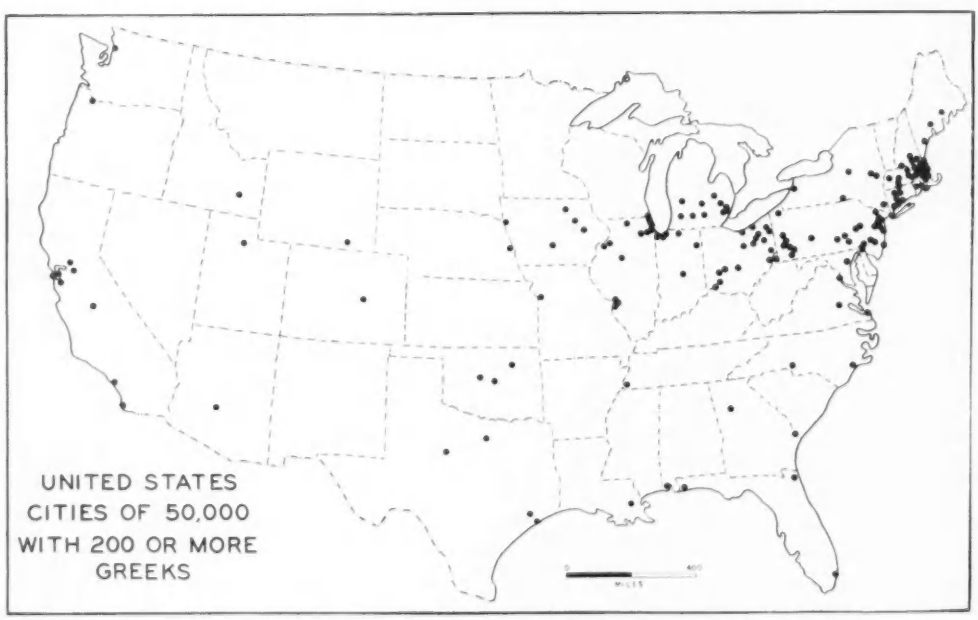
Since the immigration quota laws went into effect, only those wishing to make their permanent homes here would immigrate. Only a limited number of immigrants may enter the United States in any given year.

CAUSES FOR THE IMMIGRATION OF GREEKS

The underlying cause for departure of Greeks from their homeland is economic. Greece itself is poor and limited for new and wider enterprise. Failure of the regular crops and particularly currants in 1891, drove many to America in search of work and subsistence for their families and themselves. One of the greatest incentives to immigration was the effect of letters written from America and funds sent to the folks at home. Sums comparatively insignificant in the United States seemed substantial in Greece. Those who had come to the United States, even though living under conditions not too favorable, would still write letters home saying how well off they were to salve their pride. Such news, strengthened by visible evidence of money enclosed, spurred relatives, neighbors, and friends to emigrate to the United States at a great rate.

The temporary immigration is made up of unskilled laborers. In leaving Greece they expect not to develop ties abroad, but to save dollars, and when enough dollars have been accumulated, to return home. Many, liking American ways, ideas and customs, and disappointed at their dreams of luxury and ease in Greece, returned to the United States.

Factories in the United States needing large reservoirs of cheap labor sent agents to villages in Greece to recruit labor they so badly needed. Dr. Basil Despotes, a citizen of Boston, Massachusetts, states that he can remember such an agent visiting his town when he was a boy. Steamship companies maintained offices in every city in Greece. Greek farms were mortgaged in order that at least one member of the family might emigrate to share in the wealth that was to be won in the United States. Several other reasons for the emigration can be mentioned, but the underlying cause remains economic.



United States cities of 50,000 or more with 200 or more Greeks.

CHARACTERISTICS OF GREEK IMMIGRATION

One of the outstanding characteristics of Greek immigration is its impermanence. The Greek was unwilling at first to make his home in the United States. Government statistics for immigrants returning to the homeland begin in 1908. It is seen that between 1908 and 1930 the number of immigrants totaled 365,938. Of these, 223,488 returned to Greece. The difference between these two figures does not, however, indicate the number of foreign-born Greeks in the United States. Many Greeks who thought they would go home to enjoy luxuries which their American-earned money furnished them, missed the hustle and bustle of life in the United States. Upon returning to Greece they became dissatisfied with their life there and soon reëntered the United States, bringing their families with them. Many returned to Greece with the express purpose of bringing back their families and since they had not become naturalized, they reëntered as immigrants. The same is true of those who went back to Greece only for a visit. Others returned to take part in the many wars in which Greece was involved before and after the First World War, and were killed.

OCCUPATIONS OF THE GREEKS IN THE UNITED STATES

At first glance it would seem singular that so few Greeks resort to the occupations they knew in the homeland, that is, agriculture and pastoralism. The reasons are complicated but not too obscure. After 1882 the United States was a settled land, consequently, no free land was available. The Greek immigrant, although he had emigrated from agricultural and pastoral communities, had not enough money to buy land, so that a majority of Greek immigrants settled in the large industrial towns and cities. Settlement in industrial areas is a characteristic of all immigrant groups, but the Greeks tend to stay in such areas. After earning a bit of money he starts an individual enterprise which requires a small amount of capital, rather than invest his money in a farm which requires a larger amount. The farming venture in Greece, although it afforded a living, was not successful enough to offer encouragement in establishing farms here. Furthermore, the crops that are grown in the United States and the conditions under which they are grown, vary so much from the conditions which the immigrant Greek knows that he would hardly turn to farming to make his living.

With his well-developed business acumen the immigrant Greek can more profitably establish a small business, than branch into farming especially after he has formed neighborhood ties.

Representative businesses in which Greeks engage are restaurants, wholesale grocery houses, hotels, cigarette manufacturing, shipping concerns, ticket agencies, moving-picture houses, furrier establishments, shoe-repairing shops, and confectioneries. A table taken from L. Holland in a study of population groups of Haverhill, Mass. presents a good general picture of the occupations of the Greeks in an eastern industrial city.

OCCUPATIONS OF GREEKS IN HAVERHILL, 1939

Shoe workers	399
Shoe clerks	36
Merchants	23
Barbers	23
Hatters	16
Laborers	16
Tailors and cleaners	15
Restaurant and coffee houses—owners	15
employees	15
Manufacturers of shoes and shoe ornaments	13
Bakers	13
Tanners	12
Confectioners	8
Shoe shine and repair	8

Greeks came to Lowell in 1890 and almost at once began business by peddling. The financial panic of 1892 marks the beginning of employment of the Greeks in factories, chiefly cotton mills, for they could no longer rely on peddling to obtain a livelihood. Lowell is one of the centers of early Greek immigration and even today it has a Greek population of 4,488 which is large compared to the size of the city and the number of Greeks in other urban areas.

The greatest concentration of Greeks (53,741) in the United States is in metropolitan New York, including the five boroughs, Westchester, Nassau, and Suffolk counties in New York; Hudson, Passaic, Essex, Union, and Bergen counties in New Jersey. A few of them are employed in cigarette factories but the greater number are engaged in the small trades; for this largest of urban centers has need of the type of business that Greeks maintain.

The Reverend John Danaskos of Rochester, New York, says that 90 per cent living in his community own their own establishments. The other ten per cent are working in war factories or are employed by other Greeks.

Many Greeks who live in Pennsylvania are engaged in mining coal in the western counties. Technical changes in the mining of coal in the beginning of this century made possible the use of large numbers of unskilled laborers when the greatest immigration of Greeks was taking place.

The town of Tarpon Springs in Florida is unique. Sponge fishing is the chief industry, and Greek fishermen who have fished for sponges in the Dodecanese Islands in the Mediterranean came to fish for sponges, much as they had always done at home. About half of the entire population of the town is Greek and many of the ancient customs are still maintained. The settlement dates from 1905 when sponges were first discovered. The present war closed the Mediterranean source of supply for sponges and Tarpon Springs is extremely important in producing sponges for war industries.

Most of the Greeks who settled in Mobile, Alabama, according to the Reverend S. Haginas, were seamen when they came. They settled in Mobile, opened restaurants or one of the other small businesses, and have not been to sea since. About sixty years ago, a Greek fisherman settled on Dauphine Island. His children, grandchildren, and great-grandchildren are still fishermen there, but because there was at that time no Greek community, they married into other nationalities and have lost all contact with their Greek heritage.

In Norfolk, Virginia, as in every community with few exceptions, the majority of Greeks are engaged in business, according to a letter received from the Reverend Nik. Penatisis. This is also true of the Greeks who live in Augusta, Georgia, as testified by the Reverend Louis Skipitary.

The Greeks in Akron, Ohio, first came in as railroad section gangs until at present there are 350 families. The Reverend John Kapenekas has kindly formulated a table of their occupations:

175 restaurants	2 coffee dealers
5 candy stores	1 fixture store
25 liquor stores	3 doctors
3 meat markets	6 teachers
5 groceries	220 rubber workers

Throughout the West the work on the railroad lines was done by immigrants from southern Europe (Greeks, Bulgarians, Rumanians, Croatians, and Italians). In the warm months of the year they worked on the railroads, living in freight cars, and in the winter months they went to some city to spend their money and time in the coffee houses which were many in number in

the large cities. The large concentrations of Greeks in Chicago is accounted for by Chicago's location. It is the railroad center of the United States and most of the Greek railroad workers spent the winters there. At present, the railroad workers are very few but the small trades and businesses occupy most Greeks.

Miss Helen Cassimus of Fresno, California, says that the Greeks living in that city came by way of the railroad section gang. Soon they entered the businesses so typical of Greek enterprise, besides being engaged as laborers in packing houses. The life of the Greek people of Fresno is about the same as all other Greeks in the United States. They cling tenaciously to their traditions, religion, customs, and even a few superstitions.

The early settlers of Greek origin landed as sailors on the shores of Oregon and in the vicinity of Astoria devoted themselves to the fishing industry. Those who came later earned their livelihood by working on the railroads and others worked in the sawmills and logging camps. Mr. Thomas D. Volgas, secretary of the Hellenic Community of Oregon who is my informant says that in later years they became engaged in the small trades and at present the majority are engaged in the professions or business.

SUMMARY

Greeks are a widely-scattered people in the United States. The nature of the businesses in which they engage is one of the chief reasons for their wide distribution. Although they come from an agricultural and pastoral country, their well-developed business acumen affords them a better living in the United States than resorting to the occupations they knew in the homeland. Greeks have a very highly developed religious sense so that they are likely to be found living in communities, for only then can a church be started and maintained. Although they often live in communities, their number, when compared to other foreign white groups, is so small that they cannot be said to exert a strong influence upon other nationality groups.

The close coöperation among the Greeks in their economic life has resulted in practically monopolies in certain businesses. Representative business in which they successfully engage are restaurants, wholesale grocery houses, hotels, cigarette manufacturing, shipping concerns, ticket agencies, moving-picture houses, furrier establishments, shoe-repairing shops, and confectioneries. They usually engage in businesses in which their compatriots have been successful; as they prosper they scatter and almost every small town in the United States has at least one representative.

Greeks are usually urban in habitat and when they live in large industrial cities many are employed in the factories of the city in which they live.

FOREST IN THE NEW BRIGHT TOBACCO BELT OF NORTH CAROLINA

Parnell W. Picklesimer

The Region

IN the New Bright Tobacco Belt of North Carolina the forested resources give rise to an industry only second in importance to agriculture (Figure 1). The region lies almost wholly in the inner portion of the Atlantic Coastal Plain, and comprises an area of about 5,000 square miles. The land has a slight tilt toward the southeast, and is drained largely by the Tar, Neuse, and Northeast Cape Fear rivers. While about 70 per cent of the land is in farm ownership, the forest land, including that in farms, occupies 63.3 per cent of the unit area.

Character of the Forest

The forests occur in small patches throughout the agricultural land as well as in extensive unbroken tracts. Open land usually lies adjacent to the roadways but nearly every field is bordered on at least one side by woodland. Forest lands are also held in relatively large tracts by sawmill operators and by such non-operators as railroads, banks, insurance companies, heirs of dissolved lumber companies, interests prompting drainage projects, and individuals. A rather high proportion of the better forests occupy the low, swampy areas, and the stream margins (Figure 2).

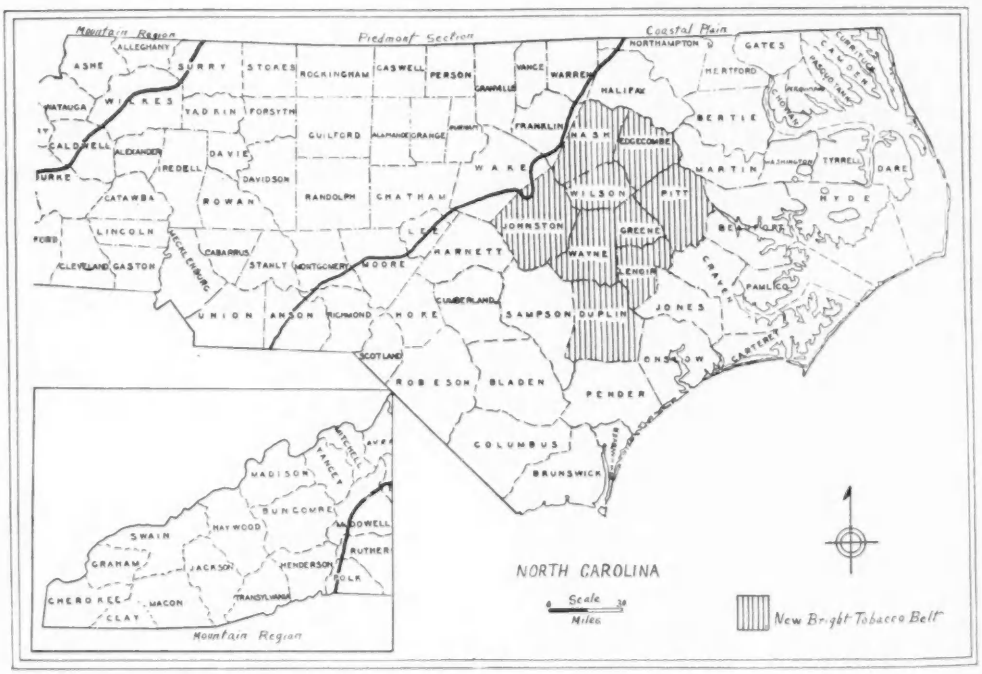


FIGURE 1.—Map of North Carolina, showing location of the New Bright Tobacco Belt.

FIGURE 2.—Map showing location and distribution of the boglands and so-called uplands in the region. The boglands harbor much valuable cypress and black and tupelo gums.

Some of the timber is inaccessible with the present methods of lumbering.

The forests contain several kinds of merchantable trees. Loblolly pine is the most prevalent single species, being found on all but the wettest lands. The loblolly pine-hardwood type of forest has restocked abandoned fields and cut-over longleaf land, and makes up approximately 45 per cent of the total forested area. The eastern and southern portions of the Belt possess large amounts of cypress, a distinct product of the swamp. Next to the loblolly pine-hardwood type, black and tupelo gums are the most abundant species group, but are not being utilized in proportion to their rate of increase. Red gum is widely dispersed. Longleaf pine, once dominant in the region, is now of minor importance. Duplin County has the largest concentration of bottomland hardwoods, but oaks (especially large white oaks) are most common in the so-called uplands of the Tar and Neuse river sections (Figure 1). Although cutting has been very heavy, there remains a large acreage of excellent second-growth pine.

FOREST INDUSTRIES

The forest industry, which reached its peak in 1916, is still the region's second most important industry (Figure 3). The average layman is surprised to learn that at present there are 174 forest-industry plants in the area. These are distributed throughout every county (Figure 4). The present industry is dominated by small portable sawmills, operating largely in second-growth timber, and averaging a change in location about four times a year. There are a few mills, however, with an operating capacity of 20,000 to 40,000 board feet of lumber per day. Important mill products are lumber, cross ties, and veneers. In addition, a large volume of wood is removed from the forest each year in the form of fuelwood, hewn cross ties, mine props, poles, and piles. Rapid progress in rural electrification, although temporarily slowed up, has

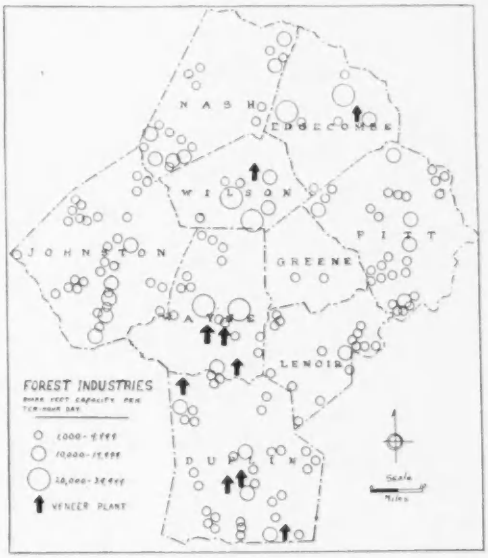


FIGURE 3.—Map showing location and distribution of forest industries in the region.

FIGURE 4.—One of numerous sawmills in the region.

created a demand for 35-foot pine poles (Figure 5).

MARKETS

The location and diversity of markets for forest products favor production. The large consuming centers of the Northeast, including Philadelphia and New York, are within truck haul of this region. The furniture industry in the near-by Piedmont area of the state provides a market for hardwood lumber and veneers. There is also a demand for hogsheads, boxes, crates, and baskets in which to market tobacco and vegetable truck crops. The erection recently of several training centers for the armed forces in the eastern part of the state has given an added impetus to the industry. These markets, together with the rising prices for wood products, provide a strong incentive for timber-growing.

THE OUTLOOK

Under existing conditions of forest use, the pine-growing stock is decreasing in volume and the hardwood stand, while increasing, is building up a surplus of increment only in the less valuable species. Fire protection is lacking on about one-third of the forest land; and, in some counties, the tax rate on such property is too high and burdensome to permit profitable growing of timber crops. However, because of its favored position in relation to the markets, this region can profit from an expanded forest conservation program.

FIGURE 5.—Marketing 35-foot pine poles.

BABASSU NUT

Anna G. E. Simmons

IN the lower Amazon Basin just south of Para, reaching from Bahia into Amazonas, and stretching far equatorward across the plains and up the wide valleys on to the slopes of the old worn-down highlands in northern Minas Geraes, Goyaz, and Matto Grosso, grow vast and almost pure stands of the wild babassu nut palms (Figure 1). The growth is especially dense in the states of Maranhao and Piauhy. One member of the Forestry Research Commission of Brazil states, after a prolonged trip through this babassu area, that the numbers of this oil palm are "so large that one can travel by rail and by river boat day after day without seeing the end of same, such is their prodigous abundance." Much of the area has not yet been explored by land but only surveyed from the air. The green palms appear to reach interminable distances thus conveying the impression that almost limitless tonnage of oil-producing kernels can be gathered here. The northern section seems to be of the greatest significance with an approximate 13 billion palms having an estimated 13 trillion nuts.

Over this extensive low undulating region the soils, in which the babassu grows, are moderately heavy but friable. They lose their fertility rapidly, however, because the climate causes such heavy leaching. Temperatures are uniformly but not excessively high (Figure 2). Para, near the northern border of the babassu region, has a maximum on the hottest days not exceeding 90 degrees F. Nights are generally sultry, but the minimum temperature has never been known to fall below 64 degrees F. The monthly range is only three degrees. The mean relative humidity is 93 per cent during the rains, and 85 per cent in the dry season. The heavy yearly rainfall (Figure 2), 90 inches at Para and somewhat heavier to the south, has a maximum of 17.8 inches in April. Rainfall records do not indicate a double maximum as might be expected near the equator. Most of the rains occur in copious downpours although it sometimes rains almost continuously for 24 hours or more but a rainless day is almost unknown. During the drier season the almost daily thunderstorms account for much of the rain.

In this climatic environment, relatively favorable for the species (Orbignya speciosa) sometimes reaches a height of 70 feet with a diameter of nearly two and a half feet. The tree begins bearing fruit when it is eight to ten years old. The average annual production of each tree is four or five bunches. Each bunch has about 1,250 nuts, of about the size and shape of lemons.

For many years before the white man began his exploitation of this wild palm nut the native realized something of its value and has utilized every part of the tree. The 15 or 20 flat green leaves, often 25 feet in length, are used in roofing and partitioning the native's hut. Narrow strips of dry leaves are made into baskets, bags, mats, sacks, and hats. Strips of the trunk of the palm serve as props for his hut and for numerous other purposes. The raw sap is coagulated into food for his mules and horses. The nut cluster-stalks are left to rot on the ground, adding a valuable fertilizer to the much too-easily depleted soil. The whole nut is

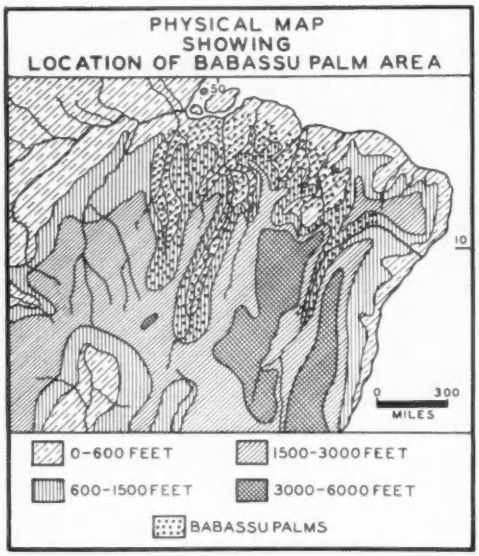


FIGURE 1. Physical map showing location of babassu palm area.

commonly used to produce smoke to coagulate the latex in the wild rubber producing region. All parts of the nut, including the pericarp, mesocarp, endocarp, and kernel, have many uses. Tough, resistant fibers scutched from the husks are locally used in the making of twine, rope, and fabric. A nutritious meal for bread is made from the mesocarp.

Experiments carried on in the United States by experts have proved that the mesocarp contains ingredients of dynamite important in our defense preparation. The endocarp, forming 75 per cent of the nut, is often used in place of the tagua or vegetable ivory nut in manufacturing buttons and insulators. Over 600 grams of oil are extracted from each bunch of nuts, and this kernel oil finds an importance in lubricants, fuels, medical salves, and perfuming medium in the manufacture of soaps. Babassu oil serves as an excellent substitute for lard and olive oil in the human diet and it is considered by some to be equal in nutritive value to dairy butter when made into margarine. The residue meal left after the oil is extracted is fed to cattle in the form of cake or bran, and often it is fit for human use. Export of the kernel meal cake in 1939 amounted to 2,065 metric tons, and meal to 568 metric tons. The shell is used chiefly for fuel in river boats and railways, especially in the northern part of the region where it is abundant. From the shell the process of distillation at temperatures of 350 degrees C. to 450 degrees C. produces a coke superior to mineral coal in many respects. The coke has a higher density and lower ash content than wood charcoal (Figure 3). Analysis of results produced by dry distillation of the babassu shell and wood show that for the shell all yields are higher except in methyl alcohol (Figure 4).

In early 1942 kernel collection mounted into the thousands of tons. Methods of gathering the nuts are still rather primitive, and are mainly done by filling a sack made of babassu fiber or a basket, deftly thrown over the gatherer's shoulder and toted to a donkey-drawn cart standing in one of the tributary paths leading to the railroad track. Here they are either shov-

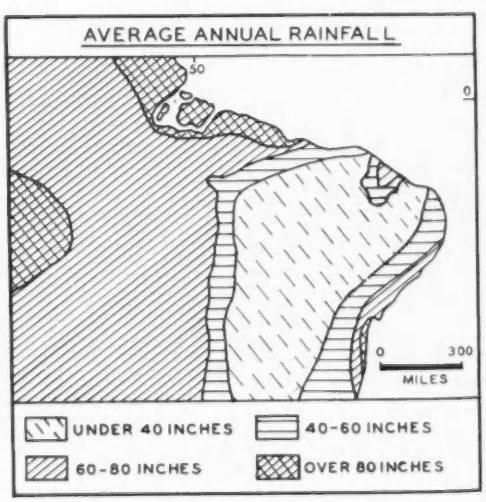


FIGURE 2. Average annual rainfall.

eled or scooped by a basket into the freight cars on the narrow-gauge tracks. Frequently a donkey with a panier thrown across his back is seen in these groves carrying heavy loads along the winding paths. In areas near navigable streams small river boats, dugouts, and crude rafts are generally used for transporting nuts to the mills. While some of the few railways are privately owned, most have been built at the expense of the government. It is thought by some, that if the sufficient transportation in this immensely rich vegetable oil region were modernized, enough oil could be exported to supply the needs of the Western Hemisphere. Large quantities go to waste at present. A recent traveler reported, on returning from his trip over the best babassu-producing area stretching from Grajahu to Barrado da Corda, that he saw babassu nuts lying three feet deep under the trees from which they had fallen. Only the top layer could be retrieved as rot injured those lower down.

Women and children are employed in handcracking the hard nuts with wooden mallets or iron hammers. A skilled worker can break and separate about 16 kilograms of kernels from the shell for the oil pressers in an eight-hour day. The average pay is 5 milreis a day, about 25 cents in United States money. Labor, both in gathering and handcracking is scarce and often inefficient. European whites and native Indians predominate. Most of the whites are of the manager-overseer class while the Indians are of the rather indolent type working only intermittently. All the workers in Maranhao, numbering over 75,000, produced in a recent year over 42,000 tons of shelled kernels which were graded in three sizes (1) 7,000, (2) 10,000, (3) 12,000 kernels to a metric ton. One observer estimated that the wooden mallet or iron hammer injured or damaged four-fifths of the shelled nuts, while larger quantities became rancid if shipped long distances.

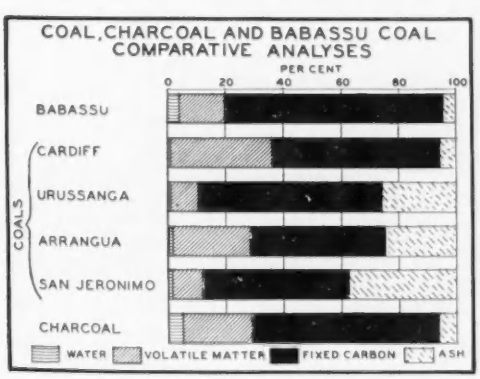


FIGURE 3. Coal, charcoal, and babassu coal; comparative analyses.

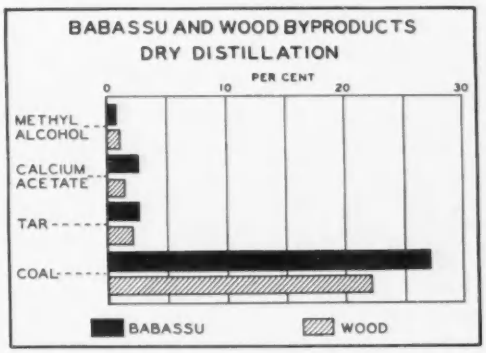


FIGURE 4. Babassu and wood by-products; dry distillation.

Most of the oil crushing mills are of the modern type. The larger ones are located in Para and Therezina. Several soap and oil factories process their own oil directly. Spacious public parks, playgrounds, moving picture houses, where practically all the films exhibited are of Hollywood's creation, are among the inducements offered the workers by the oil companies.

The San Luiz-Therezina babassu area, second only to the Maranhao region is estimated to include hundreds of millions of trees. Piauhy has and is expending huge sums of money in building new roads, improving old ones, and expanding port facilities at Luiz Corres to

encourage greater development of the industry and to more easily export the kernels and nuts. Earliest record of this cash forest crop is in 1917 with 27,000 tons; by 1941 production had reached about 50,000 tons (Figure 5).

Before World War I, Germany was the first to realize and to profit by huge importation of the rich oil-containing babassu kernels. Although we imported some thousands of tons, it is only recently that the United States has become the chief purchaser. In 1939 the United States and Chile procured the bulk, and Denmark ranked third.

Because of present war conditions and also because of the lack of petroleum in Brazil, many experiments have been conducted with the oil of the babassu nut. Among these was its successful use in internal combustion engines giving rise to the eager speculations on the probable great decrease in future imports of mineral oils. (In 1940, imports in Diesel oil from the United States alone were valued over $2,000,000.) So great is the potential vegetable oil supply that some experts prophesy that this already very remunerative industry is a source of wealth for Brazil over five times greater than that of the coffee crop.

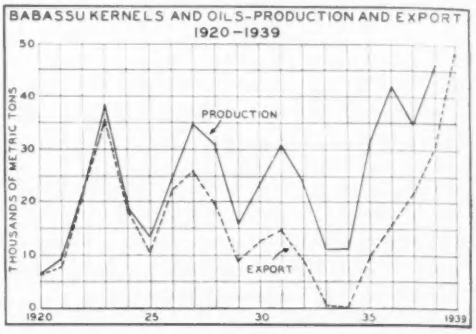


FIGURE 5. Babassu kernels and oils. Production and export—1920–1939.

TRANS-ARCTIC AVIATION

*Elmer Plischke, Ensign, U.S.N.R.**

FREQUENTLY it is wise and profitable to spend a few moments in speculation on the potentialities of the future. Many improvements are bound to be occasioned by the necessities of the war, not the least of which is the impressive development in aviation. The technological advancements being perfected for war purposes today doubtless will revolutionize commercial aviation after the termination of hostilities. One of the most logical results is the linking of the continents by a network of air routes traversing the Arctic Basin.

Belief in the physical practicability and in the commercial value of trans-Arctic aviation was first manifested about the time of World War I, and in 1919, W. Brun, a German, proposed the organizing of regular flights from the European capitals via Archangel, the Arctic Basin, and Nome or Unalaska, to either Yokohama, Vancouver, or San Francisco. A few years later, in 1923, Major General Sir Sefton Brancker, Director of Civil Aviation for Great Britain, enthusiastically declared in a speech at Sheffield that the carrying of mails from England to Japan by way of the Arctic was a probability of the next ten years. In connection with the preparations for the flight of the dirigible *Shenandoah* to explore the polar "white spot" between Alaska and the North Pole, Rear Admiral William A. Moffett, Chief of the Bureau of Aeronautics of the United States Navy, stated in 1924 that polar air routes connecting England, Japan, Alaska, and Siberia are possibilities of the near future.

Many writers have since expressed their belief in the future of trans-Arctic flying. But perhaps the most vocal of these exponents is the polar explorer and publicist, Vilhjalmur Stefansson, who has been pointing out the positional importance of the Arctic Basin for the past 20 years. On a map which has the North Pole as its center, he explains, the Arctic constitutes a small hub from which the land masses radiate like spokes of a great wheel, thus lying in the central part of a circular region enclosed for the most part by northerly extensions of rich and densely populated modern countries. By the logic of its position, it therefore should be one of the great transportation crossroads of the world.

A glance at the globe is sufficient to illustrate the significance of these statements. Geographers also have designed a so-called "polar projection," prepared by laying a geometric plane on the Pole at right angles to the earth's axis, and depicting the globe with the North Pole as the center and with the South Pole as the outer circumference. Parallels of latitude are ruled off at equal intervals in concentric circles and meridians of longitude are straight radial lines. As a result, the northern continents surround the central Arctic Basin and the Antarctic Continent represents an outer lacy fringe. This projection is particularly interesting if population density is indicated, for, with the exception of India and China, the areas of densest population—between which most aerial communication is likely to develop—lie immediately around the Arctic.

*All assertions and opinions are purely those of the author and are in no wise to be construed as reflecting the views of the Navy Department.

TABLE I

COMPARATIVE DISTANCES*

New York to Moscow	
Steamship and railroad—via Hamburg and Berlin	5,600
Air—via London and Berlin	5,000
Arctic—via Greenland and Iceland	4,600
New York to Tokyo	
Steamship and railroad—via San Francisco	8,000
via Panama Canal	11,200
Air—via San Francisco and Honolulu	8,800
Arctic—via Hudson Bay, Victoria Island, and Beaufort Sea	5,900
San Francisco to Moscow	
Steamship and railroad—via New York, Hamburg, and Berlin	8,300
via Tokyo and Vladivostok	15,500
Air—via New York, London, and Berlin	7,600
via Honolulu and Tokyo	10,900
Arctic—via Ellesmere, northern Greenland, Spitsbergen, and North Cape (Norway)	5,650
San Francisco to London	
Steamship and railroad—via New York	6,425
Air—via New York	6,025
Arctic—via Hudson Bay, Baffin Island, Greenland, and Iceland	5,150
San Francisco to Bergen	
Steamship and railroad—via New York	7,000
Air—via New York and London	6,750
Arctic—via Baffin Island and central Greenland	4,750
London to Tokyo	
Steamship and railroad—via Hamburg, Berlin, Moscow, and Vladivostok	12,000
via New York and San Francisco	11,250
Air—via Moscow	6,200
via New York, San Francisco, and Honolulu	12,275
Arctic—via North Cape (Norway) and Novaya Zemlya	5,500

*All distances, given in statute miles, are approximate, because of the inadequacy and inconsistencies of available tables, maps, and charts.

TRANS-ARCTIC FLYING DISTANCES

The distances of air travel between many major locations throughout the world, especially within the Northern Hemisphere, can be markedly reduced if trans-Arctic air routes are pursued, as illustrated by the accompanying tables.

The distance between New York and Moscow is about 1,000 miles shorter via the Arctic Basin and its peripheral landed areas. From Seattle to Calcutta the distance is almost 5,000 miles shorter, while over 6,000 miles is saved along the polar route from London to Tokyo. Similarly, the distances between New York and Tokyo and between San Francisco and either Moscow or London is thousands of miles shorter via the Arctic.

Further implications of polar air geography are of striking interest. From North Cape (Norway) it is just as far to Washington, D. C., as it is to Detroit, Chicago, Des Moines, or Seattle. Chicago is as close to every capital of Europe as it is to Buenos Aires. Milwaukee, Detroit, and other great midwestern war production centers, are closer to Russia by air than are any of the great seaports of the United States.

TABLE II

TRANS-ARCTIC LONG DISTANCE FLYING

From	*To*	*Miles*	*Hrs.*	*Min.*
Berlin	Tokyo	4,900	16	20
Chicago	Moscow	5,050	16	50
Detroit	Murmansk	4,150	13	50
London	Tokyo	5,500	18	20
Los Angeles	Murmansk	5,845	19	29
Minneapolis	Bombay	8,000	26	40
Montreal	Igarka	4,650	15	30
New York	Berlin	4,000	13	20
New York	Chungking	7,600	25	20
New York	London	3,475	11	35
New York	Moscow	4,600	15	20
New York	Murmansk	4,000	13	20
New York	Tokyo	5,900	19	40
San Francisco	Bergen	4,750	15	50
San Francisco	London	5,150	17	10
San Francisco	Moscow	5,650	18	50
San Francisco	Tokyo	4,500	15	
Seattle	Calcutta	7,225	24	50

The saving in mileage and time by following these Arctic airlanes is considerable. At 300 miles per hour—

which is by no means an impossible rate of speed in the light of recent increases in flying rates—transports can easily carry their passengers and cargoes between Berlin and Tokyo, Chicago and Moscow, Montreal and Igarka, New York and Berlin or Moscow, and San Francisco and London or Tokyo in less than half the time it takes a crack train to make a non-stop run from New York to San Francisco at 80 miles an hour. Planes also can bridge the gaps between New York and Chungking, Minneapolis and Bombay, or New York and Tokyo in considerably less time than the special express train will require to cross our country. Finally, at 300 miles per hour, wherever one may happen to be, no spot on the once wide globe is farther away than 42 flying hours.

Unbeknown to most of us, much already has been done to utilize and develop these northern routes. Returning from his globe-girdling tour some months ago, Wendell Willkie flew from China to the United States, not by way of Australia and Honolulu as might very well be expected, but rather via Nome (Alaska) and Edmonton (Alberta). Strict censorship veils the full extent of the action taken in promoting polar aviation, but we are informed that millions of dollars have been spent, and that Arctic routes are constantly being flown. Preparations also are being made by the Government of the United States to sponsor and protect American interests in postwar aviation.

ARCTIC FLYING CONDITIONS

But it is frequently believed that flying conditions in the Arctic will prevent the establishment of dependable commercial traffic. True, flying conditions in the polar regions are necessarily different in many respects than they are in more temperate climates. Nevertheless, upon closer analysis it appears that most of the difficulties can be surmounted.

It is stated that the most ardent exponents of trans-polar aviation consider average flying conditions over the Arctic throughout the year to be better than they are over the North Atlantic, while the most pessimistic writers consider them probably worse, but conquerable. Stefansson, one of the most optimistic of the publicists, notes that scientists were virtually unanimous by 1930 in agreeing that Arctic flying in Alaska, to be more specific, is as safe as it is in Michigan. This, he alleges, is suggested by Pan-American Airways reports to the effect that its flyers generally are as well satisfied with their work in Alaska as in Brazil, that over half the pilots on its Alaskan lines prefer January to July, and that, assuming like equipment and ground service, schedules can be maintained through the midwinter period with an average regularity at least as good as that in the northeastern part of the United States.

Temperature seems to be no more of a flying problem in the Arctic than elsewhere. The reason for this is that planes now fly in temperatures just as severe in temperate and torrid zones while they are at high altitudes following their established air routes. As a matter of fact, today, effective combat is waged at much greater heights than was believed possible a few years ago. It is reported in the press that fighter planes now are regularly flying in the low temperatures experienced at altitudes of 30,000 and 40,000 feet or more, and our larger bombers repeatedly encounter temperatures of 25 degrees to 50 degrees F. below zero without considering it a limitation upon their effectiveness.

In the polar regions there is less diurnal change and less temperature

variation than elsewhere. Flying temperature is said to be hazardous neither at extreme heat nor at extreme cold, but at an intermediate range in the vicinity of, and especially just below, the freezing point of fresh water, for it is at this temperature that ice forms on the aircraft and weighs it down. Such freezing is not very troublesome in the tropics except at high altitudes, and even in the polar regions icing is less of a problem than it is in the northern half of the temperate zone—where air lines function regularly according to well-integrated schedules.

Various technological improvements were devised to prevent, or at least substantially reduce, the formation of an ice-covering on the wingsand fuselage of a plane. This is evidenced by the fact that fighter planes are constantly flying through the lower aerial zones saturated with the moisture which causes the icing, and perhaps especially by the fact that effective aerial warfare is being waged in the foggy and moist atmosphere surrounding the Aleutian Islands and the shipping lanes to Murmansk. Planes also are used for reconnaissance purposes at low altitudes by the Soviets along the Northern Sea Route between our northwestern coast and the Arctic ports of the Soviets.

A number of polar explorers, including Richard E. Byrd who has flown in both polar regions, contend that polar flying is practicable only at certain times of the year. The spring months, from March to May, are said to be best suited for aviation in the Arctic, because the snow is still hard and smooth and there is less fog than there is at other times of the year. But this objection seems to be concerned more with landing and taking off than with flying itself, and it certainly does not apply to long-range non-stop flying.

At first glance it would seem that a genuine problem of polar aviation is the prevention of oil from freezing and the difficulty of starting the motors in severe temperatures. But oil will not freeze while the motor is operating and can be preheated before the motor is started. The problem of starting the motor in sub-zero temperatures was solved some 15 years ago, when it was learned that fireproof hoods or special coverings can be used to keep motors warm when a landing is made, as well as for starting a cold engine. A tube leads from this hood down to a heater which conducts heat up to the motor, or powerful warming lamps may be fitted to the motor. In this manner the motor can be preheated to any temperature, and multi-motored planes are fitted with so-called "communicators," rendering it possible to warm one motor by the action of another.

The greatest obstacle to Arctic flying is poor visibility due to low-lying clouds and fog. In the 46-hour flight of the *Norge* from King's Bay (Spitsbergen) via the North Pole to the northern coast in Alaska, 16 hours—or about 35 per cent of the time—were spent in fog. Such fog is a common occurrence in the polar regions, especially where warm air, inflowing from lower latitudes over open water, meets cold air over pack ice or glacier covered land, as is the case of Arctic areas during the summer months. Almost all floating ice is said to be accompanied by fog, but when the ice is firmly attached to land, as it is in the wintertime, the atmosphere is relatively free from fog. Fog therefore seems to be a seasonal problem, but it does appear in winter in the region of the Bering Sea and the Aleutian Islands, where the warm Japan Current enters the Arctic, and along the southern edge of the Arctic pack north of Europe where the warm Gulf Stream encounters it.

But fog in the Arctic is less dense and lower lying than it is elsewhere. Since it seldom rises to a height of over 3,000 feet, planes can fly over it with little difficulty. It is also thin so that planes can cruise at low altitudes, and because there are no obstacles like mountains, except over landed areas such as Greenland, Spitsbergen, and parts of Alaska and Siberia, the Arctic pilot can see through the fog and still retain sufficient horizontal vision. When Arctic areas are properly mapped and a greater number of radio stations are in operation to give reliable bearings to the polar flyer at all points along his route, it will no longer be necessary to fly by rivers and other landmarks, as is now the case.

Opinion seems to be somewhat divided as to whether dependable regular and emergency landing facilities are available in the polar regions. On the one hand, it is believed that Arctic waters provide dangerous landing fields, for, although the water's surface often appears clear from above, it may be filled with small lumps of partially submerged ice which can easily wreck a plane as it tries to land. Because of the movement of Arctic ice, moreover, openings fail to remain open, so that a plane, as it alights upon the water, may rapidly be hemmed in and crushed by the ice. In the summer months driftwood also endangers an attempt to land upon the surface of the water.

As far as landing upon the pack ice is concerned, it is estimated that perhaps 90 per cent of this surface is too rough to be used successfully, although there occasionally are some stretches of level ice upon which a plane may safely alight. But even if the landing is achieved without mishap, it frequently is more hazardous to take off from such surfaces, especially because high speeds are now necessary.

Stefansson seems to be somewhat more optimistic concerning natural Arctic landing facilities. He claims that in number and quality the Arctic and the northern third of the temperate zone excel over the rest of the world as far as the existence of emergency landing fields is concerned, noting that there are millions of lakes which provide suitable spots for landing with pontoons or skis. These many landing fields, he continues, have given polar flying a greater safety percentage than exists in other zones, even in the tropics. On the Arctic pack ice there are few sections where good landing fields are more than 20 miles apart, there generally being a choice of two or more within the gliding range of a plane if its motors stop at an altitude of a mile or more. In support of this contention, Stefansson asserts that during a single decade at least 54 such emergency descents were made in every sort of weather, outstanding of which was the third descent of George H. Wilkins, undertaken at night in a blizzard when he alighted upon the ice pack 100 miles off the northern tip of Alaska. No life was lost in any of these descents, while the distance covered amounted to over 90,000 miles. Again, no lives were sacrificed in the search for the Russian flyer Levanevsky in 1937, in which some 50,000 miles were flown.

Contrary points of view are held concerning the suitability of the ice cap of Greenland as a polar landing field. One group of writers contends that, despite a prolonged search undertaken by the Danish Government, there is no known natural landing field in all Greenland. The ice cap is described as an undulating plain, difficult of access because it is girdled by a ring of mountains which must be flown over and which usually constitute one of the greatest hazards of aviation every-

where. In addition, there are steep, jagged fissures into which ice pours through the mountains as glaciers. Unless it is especially equipped for a perilous overland journey, an emergency landing is apt to leave the hapless party exposed to the bitter elements on the ice cap. Recently two daring aerial rescues of 15 stranded American army flyers were disclosed in the press, but both accounts leave no doubt whatever as to the dangers encountered.

The opposite point of view argues that Greenland's ice cap is the world's largest and finest natural landing field. It is said to form a continuous and nearly perfect emergency airdrome 1,500 miles long and up to 600 miles wide. Local gales along its coasts probably can be offset by selecting non-windy flying lanes. The use of the southern part of the island as a route by which military planes are ferried across the Atlantic seems to justify this opinion, at least in part.

The majority of these hazards attending polar flying may rapidly be eliminated through the perfection of technological and other improvements. Since most of the obstacles are mechanical, they apply to flying elsewhere as well. Once they are overcome, the Arctic will possess the inestimable advantage of shorter distances. Even the problem of fog can be at least partially overcome by the development of suitable radio facilities, supplemented with appropriate polar mapping, which can itself be done by planes.

As long-distance flying increases in both extent and security, there is little to gainsay the future of trans-Arctic aviation. Many aerial feats, which were believed to be visionary but a short time before the outbreak of World War II, are already looked upon as commonplace. Who can predict what will be possible within the next decade or two by a fleet of super-planes, such as the famous 82-ton B-19, with a wingspread greater than the height of a 17-story building, with fuel tanks containing 11,000 gallons of gasoline, and with a range of almost 10,000 miles—which can carry it on a non-stop flight from San Francisco via New York to London and back to New York, or from Minneapolis to Bombay. Current improvements in design and construction appear to herald fleets of mammoth 100-ton cargo and passenger planes possessing a size and flying range never dreamed of a few years ago.

TERRITORIAL JURISDICTION

It is such aerial potentialities as these that impel writers and governments to turn anxious eyes towards the appropriable landed areas that remain in the Far North. The successful establishment of trans-polar aerial communication will necessitate the construction of flying lanes, landing bases, and radio and meteorological stations. Since the ice in the Arctic is in constant motion and cannot be relied upon for the erection of permanent facilities, polar landed territory will become of supreme importance. The establishment of flying auxiliaries by the nationals of a state unquestionably will rouse their government to acquire the territorial jurisdiction necessary to preserve and maintain these facilities properly. The race for polar territory therefore promises to be very close at hand.

Under the recognized principles of international law, unpossessed territory (*terra nullius*) in the Arctic, as well as elsewhere, can be acquired juridically only by effective occupation or by prescription. By occupation is meant the intention to possess the territory in question and both the administration of state acts and the exercise of police power in sufficient strength to protect

life and property and render exceptional a breach of the laws of the occupying state. Prescription means the exercise of state authority over such a length of time as is necessary under the influence of historical development to create the general conviction that the present situation is in conformity with the international order. Contrary to popular belief, discovery does not accord a perfect title to new territory, but merely affords an inchoate title which must be substantiated by effective occupation within a reasonable length of time.

A recent Soviet school of thought has proposed a new theory to govern the acquisition of polar territory in the Arctic. It is known as the "sector principle," according to which a subjacent polar state automatically possesses all territory, discovered and undiscovered, lying to the north of its "mainland" and within the area bounded by an extension of its longitudinal extremities to the Pole. Thus, the Arctic, like a huge pie, is sliced into a small number of sectors, one accruing to each of the following peripheral states: Norway (Spitsbergen), Finland, the Soviet Union, the United States (Alaska), Canada, and Denmark (Greenland and Iceland). But this sector principle enjoys no validity under international law and has been recognized only in the municipal law of the Soviet Union. The other five Arctic states have either refrained from committing themselves upon the principle, denied its validity by implication, or openly rejected it in their state papers. Even the Soviet Government has not made any attempt to rely upon polar sectorism in its international affairs.

What, then, is the juridical status of the territory in the Arctic which is so important for the development of postwar air transport?

In some instances the reply is relatively simple. Thus, the entire island of Greenland belongs to Denmark, as acknowledged in a series of declarations made by the United States, Great Britain, France, and Japan, 1916–1920, and by the Eastern Greenland Arbitration of 1933 between Denmark and Norway which recognized the Eirik Raudes Land area as belonging to the former. But, according to the recent announcements by President Franklin Delano Roosevelt and Secretary of State Cordell Hull, the island lies in the Western Hemisphere and therefore comes under the aegis of the Monroe Doctrine, which prohibits non-American states from acquiring the island. By and large, the same is true of Iceland, except that it enjoys an unusual autonomous constitutional position with relation to the Danish Crown.

Spitsbergen, together with Bear Island, was recognized as Norwegian territory by the Spitsbergen Treaty of February 9, 1920, following at least a quarter century of dispute involving Germany, Great Britain, Norway, Russia, Sweden, and the United States. Norway also possesses Jan Mayen Island, having formally announced the extension of its jurisdiction over the island on May 8, 1929.

Since 1920 the Soviets have taken a more aggressive course of action in the Arctic than has any other state. Despite the decree of April 15, 1926, incorporating the sector principle into its municipal law, the Government of the U.S.S.R. nevertheless has adopted an active policy of effective occupation, settlement, and administration for the islands to the north of its mainland. Thus, a number of important institutions were organized, especially the "All-Union Arctic Institute" for the scientific study of the Arctic, and the "Central Administration of the Northern Sea Route" (*Glavsevamorput*) which exercises economic, administrative, and

judicial supervision in the Arctic islands. A scientific method of exploration, annexation, and colonization is being pursued. In addition, some 200 Arctic scientific radio and meteorological stations were erected, of which about 75 are located on the islands. Finally, with the assistance of an elaborate state-owned system of icebreaker and aerial reconnaissance service, the difficult Northern Sea Route, which parallels the northern shores of the Soviet mainland, is regularly traversed by a fleet of public cargo vessels, the annual shipping amounting to approximately 500,000 tons prior to the outbreak of hostilities between Germany and the U.S.S.R.

In view of this active display of jurisdictional action on the part of the Soviet Government, no pretensions have been raised by other states to territory lying within the limits of the Soviet sectoral decree, except those entertained by Canada and Norway with respect to Wrangel Island and Franz Josef Land respectively. But the U.S.S.R. has in any case established continuous settlements on Wrangel Island since 1926 and has been sending annual parties to Franz Josef Land to supply and maintain a network of permanent stations established there.

No known territory lies to the north of Alaska, and for some years the United States has raised no serious pretensions to any Arctic possessions. But considerable interest was at one time centered in Wrangel Island and a number of smaller islands lying to the north of the eastern tip of Siberia, including especially Herald, Jeannette, Henrietta, and Bennett Islands. To the north of Canada, the American Government displayed some interest in Ellesmere Island and at least on one occasion refrained from applying to the Canadian Government for licenses to fly over the Sverdrup Islands (Axel Heiberg, Amund Ringnes, Ellef Ringnes, and a number of surrounding smaller islands), which is required under Canadian law and which would have acknowledged our recognition of Canadian jurisdiction over these islands. As far as Greenland is concerned, the American Government always has been actively interested. Upon the insistence of Secretary of State William H. Seward, a valuable report was prepared on the island as early as the 1860's with a view to possible annexation; in 1910 there was some discussion of the cession of the island by Denmark to the United States in exchange for the Philippine Islands, which in turn were to be ceded by the Danish Government to Germany in return for northern Schleswig; six years later the American Government agreed not to object to an extension of Danish jurisdiction over the entire island; and, finally, within the last few years Greenland was acknowledged to constitute a part of the Western Hemisphere and is therefore subject to our special interests under the Monroe Doctrine.

The Dominion of Canada claims all of the known islands lying to the north of her mainland. This pretension has not always been respected, as indicated, so that for the past 15 years a serious effort has been made to subject the entire island empire—as embraced within the jurisdiction of the Northwest Territories and Yukon Branch of the Canadian Department of Interior—to effective state administration. This is promoted particularly by the establishment of Royal Canadian Mounted Police posts on the fringe of the islands area, by extensive police patrols centered about these posts, by an earnest attempt to enforce the Canadian legal system in the vast region, and by the exploits of the Annual Arctic Patrols, which man and supply the posts. The

Dominion, like the Soviet Union, therefore is seeking to establish an absolute juridical title to the polar territory adjacent to its mainland.

In this manner, Denmark, Norway, the U.S.S.R., and the Dominion of Canada possess, or claim to possess, all known territory within the Arctic Basin. Moreover, under international law, states enjoy all rights of jurisdiction over the air space superjacent to their domains, and the air routes which traverse the Arctic will cross the territory of these four states. If their pretensions to the territory are acknowledged as valid under law, they will be in a position to control the major share of the trans-Arctic air lanes. On the other hand, if their claims are controverted, serious jurisdictional disputes may arise, as was the case with Spitsbergen, Wrangel Island, and eastern Greenland.

To avert such controversies, it would seem advisable for the postwar conference of states to establish a practicable solution for the international control of the matter. The problem of territorial jurisdiction should be solved in advance by an international understanding through the establishment of specific principles of law, as was effected at the Berlin Conference of 1884–1885, when the majority of the Powers recognized the principle of effective occupation as essential for the juridical acquisition of African coastal lands. This is a matter of first magnitude and should be resolved before a host of jealously-regarded vested interests are created. At present, potential disputes are largely legal in nature and therefore are amenable to justiciable solution. But if proprietary interests with extensive financial backing are permitted to develop, the matter of resolution will be infinitely more difficult. Experience has shown beyond a shadow of doubt that disputes involving important economic and political interests are far more difficult to solve than are those of a purely juridical nature.

A series of multilateral air law agreements also will have to be decided upon, and it might be profitable if an international body were established to administer such problems as reconnaissance, the surveying and laying out of transport lanes, the allocation of franchises, the adoption and enforcement of administrative air regulations, and the like. But these suggestions can readily be agreed upon if the jurisdictional issues are settled.

On a number of occasions it has been proposed that remaining unoccupied polar territory be recognized as belonging to the Society of States (i.e., as *res communis*) rather than as territory belonging to no state (*res nullius*). Then no state could legally acquire a valid title to the territory and no title of an individual state would be valid as against the others. Naturally this applies only to island territory, and does not include those islands already consigned to a particular state by international agreement—as was the case with Greenland and Spitsbergen—and those islands which can be considered as appertaining to a state by virtue of prescriptive rights. All remaining Arctic island territory should be internationalized, to be administered either by the League of Nations or its future counterpart, by some special international administrative agency, or by some qualified individual state as a mandate.

THE COAL MINING INDUSTRY OF GUERNSEY COUNTY, OHIO

Robert L. Carmin

GUERNSEY County, situated on the unglaciated Appalachian Plateau of Southeastern Ohio (Figure 1), ranks ninth in the state's list of twenty-nine coal producing counties. Most of the coal mined in the county is taken from the Upper Freeport or No. 7 bed (Allegheny formation), known, where it underlies a portion of Guernsey and adjacent Noble County, as the Cambridge Field (Figure 2).

The paper opens with an historical summary of the production of the field. Production methods as they are related to the stratigraphical position and composition of the coal follow and the disposition of the mined product is discussed. The reasons behind the decline in production and the present low output will comprise an important part of the paper, and finally the future of the industry in the county will be considered. Many of the problems faced today by Guernsey County coal producers and miners and, directly or indirectly, all inhabitants of the area near the Cambridge Field, can be expected eventually to confront other soft coal mining areas of our country.

Historical Summary

The Guernsey County coal industry has reached its zenith of production and has so declined that the amount produced in 1940 was about that of 1890 (Figure 3). In 1840, 2,234 tons of coal were mined in the county and sixteen men were employed.

Production increased slowly as the usefulness of coal became known and the possibilities of transporting the fuel increased. When the Central Ohio Railroad (today the Baltimore and Ohio) was constructed in the county in 1854 a means of transportation was opened by which coal could be shipped from the northern part of the Cambridge Field (Figure 2); consequently railroad mines gradually came into existence there. The Cleveland and Marietta Railroad (today the Pennsylvania), which began operating in the 1870's, extended in a north-south direction through the heart of the field and thus opened up mining on a large scale in Jackson and Valley townships. Later, the Cumberland Branch of the B. & O. was extended from Lore City to the southeastern part of the county and this made possible the development of railroad mines across the heart of the field.

Because of the nature of the coal deposits, small-scale mines could be easily opened in this field and operated with little capital (Figures 4 and 6) thus many mines sprang up. It was the merging of smaller mines and the forming of big companies, however, that caused production to increase noticeably from around 1890 to 1910 (Figure 3). In the latter year, 4,473,022 tons were mined in the county. The year 1914 saw a great drop in production due partly to poor markets, but mainly to labor troubles which tied up the mines from April to August. Because of the war, production again rose and the peak year for Guernsey County was reached in 1918 with an output of 4,497,303 tons.

From 1918 to 1940 the production of the field has been on the decline with minor upswings at various intervals.

FIGURE 1.—Situation of Guernsey County in Ohio and the relation of certain nearby cities of importance to the county.

The county's production fluctuated correspondingly with that of the nation until the years 1925 and 1926, at which time production in the United States bituminous fields as a whole generally increased due to good business conditions and to miners' strikes in the United Kingdom and the Pennsylvania anthracite area. At this time, however, the production in the Cambridge Field was declining, and with the strikes which occurred in union fields in 1927 and 1928, the coal output was further curtailed until production was the lowest it had been in the county since 1893. With labor conditions smoothed out, production rose in 1929 and 1930 only to begin a steady decline once more, this time aided by the poor business conditions of the depression. In the decade following 1930 the output has become less each year except for 1940 and 1941 when the output responded to the increased industrial activity resulting from the national defense program. When Guernsey County coal production is compared with that of the United States for the last ten-year period, it is seen that United States production rose and fell with the tide of business conditions. On the other hand, the Guernsey County output, instead of rising with better circumstances, only slowed up its rate of decline, thus indicating that other forces in addition to the economic situation were affecting the county's coal output. A further indication of such forces is revealed by comparing the United States and county figures which show the per cent of increase of 1940 production over that of 1939. The United States coal output rose 15 per cent, whereas the increase for the same period in Guernsey County was only 3.51 per cent.

From the above facts it appears that the coal industry of Guernsey County is on the way out and destined for a position much less important than it enjoyed for the forty years between 1895 and 1935. In the former year and again in 1900, considering tons produced, the county ranked fifth in

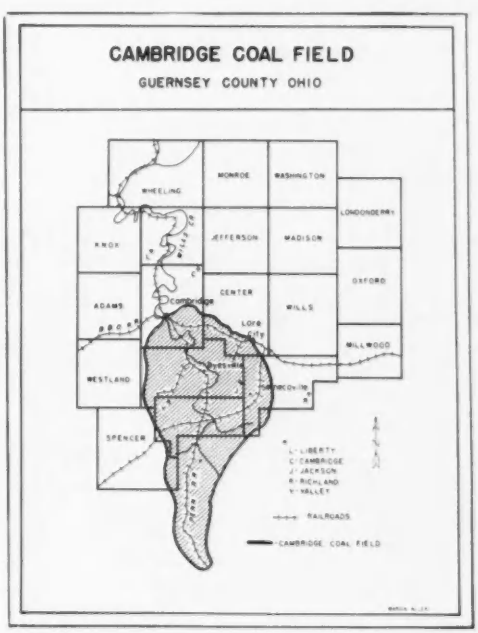


FIGURE 2.—The situation of the Cambridge Coal Field in Guernsey County.

the list of Ohio counties producing coal. It rose to fourth position in 1905 and remained there in 1910, rising to third place in 1915. In 1920 the production of the Cambridge Field began to decline, causing the county to rank fourth in that year; by 1925 it was seventh, and the year 1940 saw it ninth in the roster of Ohio producers. In the last mentioned year the county produced only two per cent of the total Ohio output.

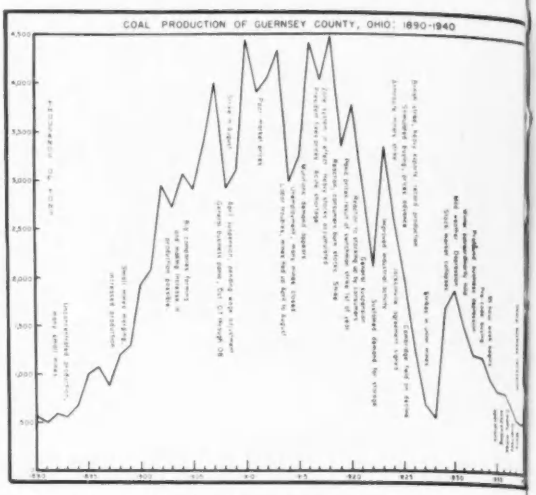


FIGURE 3.—Coal Production of Guernsey County, Ohio, from 1890 to 1940.

STRATIGRAPHICAL POSITION, KIND, AND DISPOSITION OF THE COAL

The coal-bearing sedimentary rocks of the county are a part of the great structural trough of the Appalachians, hence the beds tend to dip southeastward. Although two anticlines within the county cause local exceptions, it can be generally said that the coal beds lie deeper as one goes south and southeastward from Cambridge, the county seat.

The thickness of the bed varies from three to five feet and usually has two benches separated by a parting commonly found near the bottom. Although the bed has only one regular parting, in places it has many thin discontinuous ones, the presence of which tends to increase the percentage of ash and sulphur (Figure 7).

The Upper Freeport or No. 7 coal lies at the top of the Allegheny formation. Shale or sandstone of the lower Mahoning usually forms the roof of the mines in the county. At times the Mahoning sandstone takes the place

FIGURE 4.—The surface plant of a typical truck mine of Guernsey County. The buildings left to right are: repair shop and garage, transformer housing (tiled building), tipple, windlass house, scale houses and office. This mine is a "slope" mine; the opening cuts into the hillside at a slant of nearly 45 degrees. U. S. Highway 40 can be seen at the right.

FIGURE 5.—Miner riding loaded car from opening of truck mine shown in Figure 4. A cable (parallel to the track) is drawing the car into the tipple. On the left is a pile of mine props and on the right the housing for the transformer which changes the alternating current of the purchased electricity to direct current.

of the coal either wholly or in part. Thus so-called faults and "horsebacks" occur, causing mining methods to be more expensive and the quality of the coal to be lowered.

The average figures for sixteen samples show the coal to be high in ash (6.67 per cent). Sulphur makes up 2.19 per cent of the coal, adding to it a further undesirable quality. On the other hand the percentages of volatile matter and fixed carbon, 36.16 per cent and 50.89 per cent, respectively, are high and give to the coal a high B. t. u. value which ranged from 13,869 to 13,226 in 15 moisture free samples (see table "Analyses of Guernsey County Coals, p. 14).

The coal is primarily a steam coal as it does not make a good coke and its sulphur content prevents it being used in iron furnaces. Its structure is such that it weathers rapidly and is so friable it does not bear transportation well; hence it forms slack easily, is dirty, and is not especially good for domestic use. But viewed from the standpoint of heating value the coal from the Cambridge Field is one of the best.

Because of the nearly horizontal lying strata of the area mining is comparatively cheap. Another element that results in lower mining costs is the fact that the coal seam has been exposed on many valley sides by the dissecting streams of the old plateau area. Thus it is possible in many cases to take the coal by the relatively simple means of drift mines (Figure 6). Shaft mines are found in greater numbers in the southern part of the county because of the dip of the strata in that direction (Figure 9). The room and pillar method of mining is used exclusively throughout the county.

The bulk, or 83 per cent of the total produced in 1940, was shipped by rail to industrial plants. Although the coal is not ideal for home use, the domestic market in and around Guernsey County is largely supplied by the Cambridge Field because the nearness of the source makes it cheap.

REASONS FOR THE DECLINING COAL PRODUCTION

The factors resulting in a general decline of coal production from the Cambridge Field since 1918 fall into three general classes. One group may be called the intrinsic or the physical

FIGURE 6.—Surface plant of "country mine" showing hand operated windlass and mine opening four feet high at entrance and a foot lower three yards in. Coal is here produced for sale, but most mines of this type are worked by individuals to obtain coal for private use. Note the steep hill typical of this unglaciated portion of the Appalachian Plateau.

factors. Examples are: the amount of coal reserves, the nature of the coal and its stratigraphical position, and the location of the field. The second group is composed of extrinsic elements that are more economic in nature and not directly related to any particular coal field but to all areas of coal production. Such are the following: the competition of other power sources and the increasing efficiency in the use of coal. The third set of factors are a result of the cumulative effect set into motion by the two preceding groups.

The intrinsic factors.

Exhaustion of coal. For the sake of accuracy one must not merely say that the coal of the Cambridge Field is nearly exhausted, but should explain that nearly all of the best and most easily accessible coal has been mined out. It is commonly recognized that much coal is perhaps permanently lost because the low price received for the product does not make it profitable to mine other than the best and most accessible grades. Conservationally this is unfortunate, but the only bearing it has on this discussion is that *if* it were profitable to mine the more inaccessible and poorer grades of coal, the prospect of a long life for the Guernsey County coal industry would be much brighter. As it is, however, all of the large mines (railroad mines) except one have taken practically all of the coal which could provide a profit; profit, that is, considering the present production costs and price received for the product.

Competition of other fields. Production has been further curtailed because of the inability of the owners to compete with mines of other fields, especially those out of the state. There are three principal reasons why the county operators found it hard to compete with outstate mines. First, the wages demanded by the Guernsey County miners have been higher than those of Kentucky and West Virginia, consequently production costs were accordingly greater. The strikes that accompany unionization and wage adjustment rather early proved a further handicap to the operators. An example of such an effect was made evident to Ohio producers when they lost much of the lake (Erie) trade to mines of West Virginia and Kentucky during the strikes of 1927 and 1928.

A second factor that increased operating costs was the irregularity of the Cambridge Field. In addition to the many so-called faults of the field, horsebacks, clay veins, and irregular partings were often encountered (Figure 7). Also, because the coal seams are generally thicker in the West Virginia and Kentucky fields, operating costs were lower there. A third factor decreasing the chances of competing with southern operators was the freight rate differential to Lake Erie ports. Freight

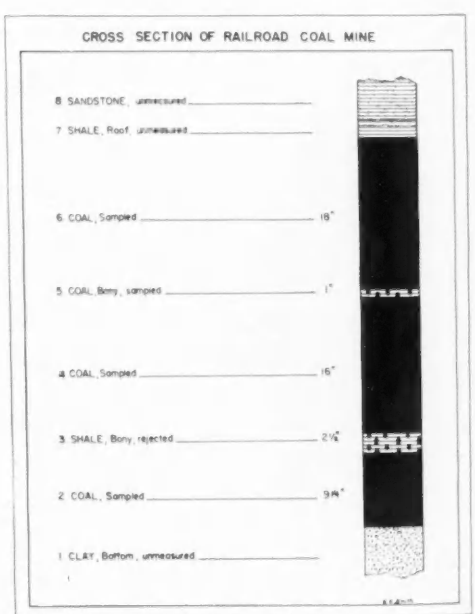

CROSS SECTION OF RAILROAD COAL MINE
8. SANDSTONE, unmeasured
7. SHALE, Roof, unmeasured
6. COAL, Sampled 18"
5. COAL, Bony, sampled 1"
4. COAL, Sampled 16"
3. SHALE, Bony, rejected 2½"
2. COAL, Sampled 9½"
1. CLAY, Bottom, unmeasured

FIGURE 7.—Cross Section of Upper Freeport Coal Bed in Guernsey County.

charges proved advantageous to the southern operators. For example, some coal fields in southwestern West Virginia and southeastern Kentucky are approximately 440 miles from the lake ports and have a freight charge of $1.96 per ton, while the Cambridge Field must pay $1.43 per ton although located around 155 miles from the lake ports. Thus shipping costs for each ton of coal from the Cambridge Field cost .922 of one cent or nearly a cent per mile, while the charge for each ton from the above-mentioned fields of Kentucky and West Virginia cost only .445 of one cent or about a half a cent per mile.

Extrinsic factors.

Two factors, though not pertaining to Guernsey County alone, affect the demand and hence the market price of coal, which results in the fact that only the better and more accessible coal can compete. The first is the ever increasing use of other power and fuel resources, especially petroleum, gas, and water power. The following figures show how coal is being partially displaced by other energy sources. The figures are for 1918 and 1938, respectively, and show the percentage of total energy contributed by each source.

The fact that petroleum, gas, and water

ANALYSES OF GUERNSEY COUNTY COALS

(ALL UPPER FREEPORT OR NO. 7 COAL[1])

Item of Analysis	*No. of Samples*		*Highest Figure*	*Lowest Figure*	*Range of Difference*	*Average of High and Low*
Ash	A[2]	16	8.05	5.30	2.75	6.67
	B[3]	16	8.51	5.65	2.86	7.08
Moisture at 105°C	A	16	6.88	4.98	1.90	5.93
Volatile Matter	A	16	38.65	33.67	4.98	36.16
	B	16	40.71	35.96	4.75	38.33
Fixed Carbon	A	16	53.30	48.31	4.99	50.89
	B	16	57.24	50.89	6.35	54.06
Sulphur	A	16	3.55	0.84	2.71	2.19
	B	16	3.79	0.90	2.89	2.34
Carbon	A	8	73.41	70.32	3.09	71.86
	B	8	78.50	74.08	4.42	76.29
Hydrogen	A	8	5.49	5.20	0.29	5.34
	B	8	5.10	4.89	0.21	4.99
Oxygen	A	8	13.68	12.09	1.59	12.88
	B	8	8.88	7.22	1.66	8.05
Nitrogen	A	8	1.58	1.30	0.28	1.44
	B	8	1.67	1.38	0.29	1.52
Heating Value Calories	A	15	7,224	6,976	248	7,100
	B	15	7,705	7,348	357	7,526
B.t.u.	A	15	13,003	12,556	447	12,779
	B	15	13,869	13,226	643	13,547
Fusion of Ash (Degrees F)						
Incipient	A	5	2,590	2,298	292	2,444
Complete	A	5	2,663	2,406	257	2,534

[1] This table constructed from data found in Bownocker and Dean, "Analyses of the Coals of Ohio," *Geological Survey of Ohio Bulletin*, Fourth Series, No. 34, 1930, pp. 307–308.

[2] Sample as received.

[3] Moisture free sample.

power are outside competitors is particularly significant since 85 per cent of the coal produced in 1940 left the county.

The second factor not directly related to the field is that of the increasing efficiency in the use of coal. A more effective use tends to lower overall demand which results in less profit for the operators. Industrial consumers especially have taken great strides in improving the efficiency of coal as a fuel, and industry is a large consumer of Guernsey County coal. The effect of the improvements has been cumulative from year to year, but the rate of decline has tapered off in recent years because the remaining margin of possible increase in efficiency becomes less. Even so, the present decline is significant. In 1940, for instance, 1.37 pounds of coal were required to manufacture each kilowatt hour of electricity as compared with the 1.39 pounds needed in 1939. An even greater difference occurred in the amount of coal required per 1,000 gross ton-miles of railroad freight service. In 1939, 113 pounds were required as compared with 112 in 1940.

FACTORS RESULTING FROM INTRINSIC AND EXTRINSIC ELEMENTS

Lack of modern mining machinery. Since World War I coal mines in general have become increasingly mechanized, but the operators of Guernsey County mines, in the light of the handicaps mentioned above, have usually considered the purchasing of certain mechanical equipment an unsound investment. Without the use of machinery, operating costs are higher because the output per man per day is less. In addition, the coal *can not* be so well prepared for market, consequently it brings a lower average price per ton than it otherwise might, thus lowering profits. In 1940 the price of the coal at the mine was $1.59 for the county, and $1.66 for the state. Of the thirty-six mines (wagon, truck, and railroad) in the county during 1940, fifteen had electric cutting machines, and only one had a mechanical loading machine. None were equipped to wash or chemically treat the coal. The relatively low average price received for the Cambridge coal is due in part to the lack of machinery with which to clean and process the coal.

FIGURE 8.—Part of surface plant of largest railroad mine in county. In the background are old slag dumps, and the buildings from left to right are: the sandhouse, the mule barn, the shower house (double building), and the long repair building. Stacks of mine props are piled by the railroad tracks. Gravity is causing the center railroad car to move to the tipple where it will be stopped by the brakeman on the car.

Failure of large mining company. Marcus Kerr, Chief, Division of Mines, Columbus, Ohio, further credits the decrease in production to the failure of a large mining company whose operations were stopped some years ago, and whose property is today in the hands of receivers. It is possible that the failure of this company, which controlled a number of mines, may have been partially the result of poor business management, but it seems likely that the combination of the above mentioned physical and economic forces has proved fatal to this enterprise. Once mines become idle, machinery rusts and decays, mine timbers rot, gas accumulates, and parts of the mine cave and become flooded. Such conditions are present in Guernsey County and they prove a further source of discouragement in the development by new corporations.

SUMMARY

Several reasons appear to account for the decline of the coal mining industry of Guernsey County. First, the choice areas of the field, that is, the more accessible coal of the principal bed, the Upper Freeport or No. 7, are nearly exhausted. Secondly, the owners are unable to compete with other fields, principally because: (a) the wages required by Guernsey County miners have exceeded those in some competing fields; (b) the irregularity of the Cambridge Field has caused high operating costs; and (c) differential freight rates have given advantages to West Virginia and Kentucky fields. A third reason for the decline is the fact that modern mining machinery was not installed. The financial failure of a large coal company which has closed a number of mines that might possibly have been able to produce for many years is a fourth factor. Additional causes for the drop in production are the factors of increased efficiency of coal as a fuel, and the competition of substitute energy sources. There is no evidence that the quality of the coal produced thus far has been responsible for the decline in production.

FIGURE 9.—Another view of mine pictured in Figure 8. Note loaded cars emerging from tipple. Structure in right foreground is house for ventilating fan and emergency exit from mine.

THE FUTURE OF THE INDUSTRY

The coal mining industry of Guernsey County has an unpromising future for several reasons. Some of the causes for the past decrease in the output are factors that will bring about a further decline. This is especially true of the matter of coal exhaustion. It should be understood the coal seams are not entirely depleted, but that most of the coal which can be economically mined has been exhausted. In other words, most of the coal now remaining in the county *can not* be profitably extracted on a large scale because mining costs are often equal to the selling price. It appears, then, that the coal mining industry of the county will continue to dwindle, with possible small upswings due to extreme demands such as wars and reconstruction periods. Production will fall off to such an extent that within possibly the next decade or two the coal output will be insignificant and mined only for local production.

FIGURE 10.—A view of Senecaville, a mining community in south central Guernsey County. (See map, Figure 2.) This is the nearest village to the large mine pictured in Figures 8-9.

Although there is no immediate promise of a rally of the Guernsey County coal industry, there appear to be two possibilities for a revival in the rather distant future. First, when many other coal fields have arrived at the stage of depletion now reached by the Cambridge Field, coal will be scarce and its market price will increase. The higher price should induce mine operators to revive the industry by reworking mines in seams heretofore considered not worth the mining. A second possibility for a rejuvenation of the industry is the chance that new and much cheaper mining methods will some day be discovered. A less expensive method of extracting the coal would mean the coal could continue to be sold for the present low price, but that mining costs would be low enough for the operators to realize a profit.

It must be remembered, however, the likelihood that these possibilities will materialize is uncertain, and that this and the coming generation will probably not see an important revival of the Guernsey County coal industry.

THE WESTERN RESERVE OF CONNECTICUT: GEOGRAPHY OF A POLITICAL RELIC

John H. Garland

THE Western Reserve, the northeastern part of Ohio which was once claimed by the state of Connecticut, is now characterized by a mixed culture of old New England and modern America. The New England background is especially evidenced by the many regularly spaced old villages. Each village is dominated by a square, and New England architecture is everywhere present in the fine old homes and colonial churches. The modern American development is best exemplified in the cities where commerce and industry have strongly attracted foreign immigrants. The Cleveland Metropolitan District, famous for its cultural gardens and nationality groups, is the most outstanding. Akron and Youngstown are the centers of the two lesser urban districts. Although long since impotent, the roots of the past still leave their indelible imprint on the present-day culture and give to that portion of Ohio the illusive name of the "Western Reserve."

A Political Relic

The Western Reserve is not a region but rather a relic of past political conditions. After the Revolutionary War, when the eastern states were relinquishing their claims to western lands, Connecticut gave up all claim to western territory except the land between the 41st and 42nd parallels of latitude extending 120 miles westward from the Pennsylvania line. This part of the present state of Ohio was known as the Western Reserve of Connecticut (Figure 1). Although contrary to the Ordinance of 1787 which created the Northwest Territory, Connecticut sold a tract of 25,450 acres in the Mahoning Valley in 1788, and in 1792 gave a tract of one and a half million acres in the western end of the Reserve to approximately two thousand citizens of Connecticut who had suffered damages to their homes during the Revolution. This portion of the Reserve was known as the "Fire Lands." Later Connecticut deeded the remainder of the Western Reserve to a small group who organized the Connecticut Land Company, surveyed the land, and finally sold it to individual owners. In 1800 the state of Connecticut relinquished to the United States all jurisdiction to the Western Reserve. Because of its early development the Western Reserve was dominantly New England. Connecticut people settled the land and brought to it their customs, and today, especially in the rural districts, the imprint of New England still remains.

Urban Occupance

Upon this transplanted New England colonial background has been superimposed a modern urban culture conspicuous for its foreign elements. Although the foreign population tends to concentrate in the urban areas, the rural districts have also received a share of the foreign born. This is especially true of districts in which vineyards, orchards, and stone quarries are important and where skills acquired in foreign lands are adaptable. It has been the development of industry within the cities that has been the real attraction to the foreign immigrants who have tended to live in clear-cut, well-marked nationality

FIGURE 1.—The Western Reserve of Connecticut.

groups. The varied industry of the Cleveland Metropolitan District, the heavy industry, notably iron and steel of the Mahoning Valley, and the well-known rubber industry of Akron have all exerted their pull on the foreign groups.

Related as the several occupance types are to the Appalachian Plateau, the lacustrine plain, and the till plain of the Interior Lowland, several distinct occupance districts are readily recognizable within the arbitrary boundaries of the Western Reserve. From the point of view of area, rural districts are dominant, but from the point of view of cultural dominance, urban districts are outstanding. The largest, the Cleveland Metropolitan District, occupies the lower Cuyahoga Valley at about a mid-position in the Western Reserve. The Akron Metropolitan District to the south dominates the uplands between the Cuyahoga and the Tuscarawas valleys. The third and smallest urban district, dominated by the city of Youngstown, occupies the Mahoning Valley in the southeast (Figure 2).

Thus the present-day occupance focuses upon the Cleveland-Akron alignment which occupies the center of the region. To the west is a rural sector alike in many respects yet differing in others from the rural area to the east. Somewhat detached is the Mahoning Valley industrial area in the southeast. Although not a region in the strictest sense the Western Reserve has a real unity based upon its early development.

CLEVELAND METROPOLITAN DISTRICT

The Cleveland Metropolitan District is extensive, consisting of the city of Cleveland and many smaller cities, towns, and villages grouped in a fairly compact yet widespread pattern. Innumerable functions are centered here, which, reaching far and wide into the world of affairs, make of this district an inter-regional capital.

Urban Structure—The urban district centers on the core of Cleveland where the Public Square, indicative of its New England background, is surrounded by public and commercial functions. This focal point occupies a portion of the lake plain east of the lower Cuyahoga River near the lake front. Surrounding the core is an extensive intermediate area dominated by manufacturing, wholesale commercial activities, social and political institutions, and blighted, decadent residential districts. Adjacent to the core in the Cuyahoga Valley are the Cleveland Flats, the iron and steel center of Cleveland. On the lake front, shipbuilding, chemical industries, and the like, as well as harbor facilities occupy positions on both sides of the core. The remainder of the intermediate zone is characterized by an indiscriminate mixture of functions. Many small industries occupy railroad sites. Social and political functions utilize the well-built old homes in what formerly was an outstanding residential district. Euclid Avenue, once famous for its millionaire homes, is now conspicuous in this respect. Poor residential qualities dominate much of the district. It is here, especially in the southern and eastern portions, that the foreign population groups are found, and, as might be expected, it is within this same zone

that the several federal housing projects have been developed.

Beyond the intermediate zone is an extensive periphery in which residential as well as industrial activities are outstanding. This wide zone is largely beyond the political boundaries of Cleveland and is therefore composed of suburbs and satellitic cities. On the east much of the periphery occupies the higher land of the Appalachian Plateau and is known as the "Heights." Here, on a pleasant, wooded, rolling terrain, highly restrictive residential districts have developed. The first residential utilization was by large estates. In part due to improvements in transportation, it is now a fine residential section, the homes of which range from small well-kept cottages to extensive estates. On the narrow lacustrine plain, traversed by several railroads, is a new industrial district in which airplane parts, precision machines, brass goods, and defense products are made. Due to war conditions this portion of the periphery has witnessed an extremely rapid development which has caused the housing problem to become acute. One of the several unit housing projects has been developed here.

On the west the periphery is not as extensive as it is on the east. The better residential districts are found in the lake shore suburbs, whereas the Cuyahoga Valley residential section tends to feel the pull of the heavy industries along the railroad. This section also is dominated by extensive areas of greenhouses which cluster along the old beach ridges on the lacustrine plain.

Surrounding the periphery is an extensive extra-periphery which is an area of mixed urban and rural functions. The desire to live in the country seems to appeal widely to all classes and as a result all types of rural-urban communities are present. Improvements in transportation have greatly aided this movement, and old villages have been added to the Cleveland Metropolitan District and new ones have developed. Likewise, fully developed cities, such as Elyria, have become a functioning portion of the larger unit (Figure 2).

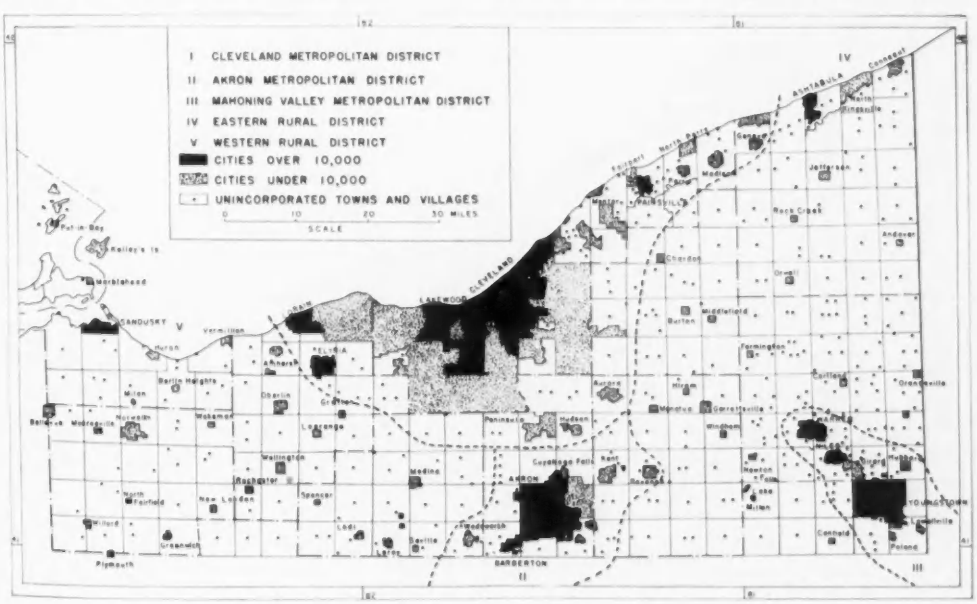


FIGURE 2.—Districts of the Western Reserve.

The eastern portion of the extra-periphery is by far the largest. Here on the picturesque, rolling upland, extensive estates and exclusive subdivisions have developed. Old New England villages, such as Gates Mills, founded in 1793, have become the centers of modern development, whereas numerous new subdivisions have developed as a result of rapid transportation and vigorous real estate development. The lack of railroads in this portion of the upland has placed the full burden of transportation upon the highways (Figure 3). Well-cared-for wooded estates, private air fields, and polo grounds are evidences of the presence of wealth in this residential district. On the lake plain, following the route of railroads, are numerous towns and villages more compact in pattern than those on the upland. Here chemical and rayon factories, orchards and nurseries, as well as residential functions are closely spaced. Because of the corridor nature of the narrow lacustrine plain, separated by the steep face of the Portage Escarpment from the adjacent upland, the extra-peripheral zone is extremely wide, extending eastward almost to Ashtabula (Figure 10).

On the south the extra-periphery, in this case largely on the Interior Lowlands, consists of incorporated townships. In characteristic New England manner an old village occupies the center of each township, but its political jurisdiction has been extended to the township borders. Thus a great deal of farm land as well as much unused potential urban real estate are dominant features of the landscape. Although there are many fine country homes the evidences of wealthy rural living of the upland section are markedly absent, and in its place are many little cottages and three acre home sites.

On the west the extra-periphery is smaller and is characterized by the presence of completely developed cities such as Lorain and Elyria. The rest is a series of small towns and incorporated townships utilized alike for truck farming, orchards, and part-time farms as well as for residential purposes for the larger urban communities.

Another feature characteristic not only of the extra-periphery but also the several inner zones, excepting the core, is the presence of an extensive system of metropolitan parks following the courses of the Cuyahoga River,

FIGURE 3.—Ore Dock of Republic Steel Co. Inner Harbor, Cuyahoga River, Cleveland. Courtesy of Adelaide Blouch.

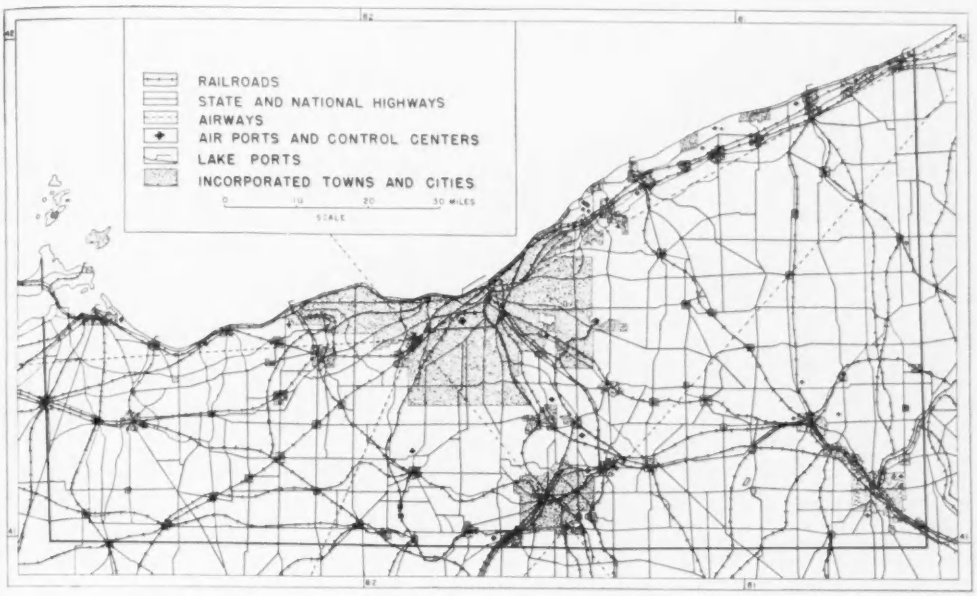


FIGURE 4.—Patterns of Transportation.

Rocky River, Euclid Creek, and several smaller streams. These stream valleys, deeply incised in the shales and sandstones, form splendid playgrounds readily accessible to the one million or more people in the Cleveland Metropolitan District.

Qualities of Situation—The importance of the Cleveland Metropolitan District is explained in a large measure by its situation and for that reason it is more than a portion of the Western Reserve. Since it is located on the southern shores of Lake Erie where the Appalachian Upland abruptly meets the Interior Lowland, east-west as well as north-south transportation of all types tends to focus here. Railroads and highways from the Middle West to the Eastern Seaboard skirt the lake and concentrate on the narrow lacustrine plain eastward from Cleveland as they follow the lowland route to the east coast. Likewise routes from the south tend to focus here in a great fan-shaped pattern (Figure 3). The major lineaments of this pattern are composed of routes from St. Louis and Indianapolis, from Louisville and Cincinnati, and from Pittsburgh. The lack of east-west railroads in the upland east of Cleveland is a significant feature. Highways, however, tend to be somewhat more regular, although they too break the grid pattern to focus on the city.

The major air route from Chicago to New York passes directly over Cleveland as well as minor routes from the north and south. Thus Cleveland has become a major airway traffic control center.

To the north the crescent-shaped pattern of the Cleveland Metropolitan District faces Lake Erie and here one of the major lake ports has been developed. All routes from the Upper Lakes center here, as well as on the neighboring ports, for the purpose of unloading ore for the important iron and steel industries of the immediate hinterland. In the same manner coal from the Appalachian Field is moved to the lake and is distributed to other portions of the country by boat. However other

FIGURE 5.—Entrance to Inner Harbor, Cuyahoga River, Cleveland. Courtesy of Adelaide Blouch.

lake ports are more important in this respect. General freight and passenger traffic is also notable, especially traffic between Cleveland and the terminals of Buffalo and Detroit. Although a product of the Western Reserve the Cleveland Metropolitan District owes its significance largely to its situation and thus becomes a functioning unit of regions of greater magnitude.

AKRON METROPOLITAN DISTRICT

In magnitude, the second urban area is the Akron Metropolitan District (Figure 2). Unlike its neighbor, commerce is of secondary importance, whereas industry is the dominant note in its personality. That the Akron Metropolitan District is the center of rubber manufacturing is a well known fact. Neither location nor the presence of abundant resources are important factors in the Akron development.

Situated on the watershed between the Tuscarawas and Cuyahoga valleys the Akron district has had ample room to expand in all directions, although it has tended to elongate its pattern in a northeast-southwest manner. The core of the city, occupying the highest part of the watershed, centers at the point of the metropolitan district where highways tend to focus from all points of the compass (Figure 3). In characteristic manner the core is the retail commercial center. Surrounding the core in roughly a concentric ring is a secondary district of residences, wholesale commercial activities, and industry. It is in this district on the south and east that the rubber factories are located. Since they are largely dependent on railroad transportation, the railroad pattern focuses on the immediate zone just east of the core. Although rubber manufacturing is the outstanding industry, a host of others including the making of cereal foods, wood products, farm machinery, and the like are distributed through the intermediate zone, especially in the area east of the core.

Beyond the intermediate zone is a well-marked periphery composed of a variety of cultural features. On the south is an extensive industrial district including several of the new rubber

factories and the municipal airport where the famous zeppelin hangar is located. The west is largely residential and is one of the newer and better areas in which parks and golf courses have been widely developed. Likewise the northern portion of the periphery is residential. The east, to a great degree, consists of older and poorer residential areas. The outer portion of the Akron Metropolitan District is elongated towards the northeast beyond the city of Cuyahoga Falls to the towns of Kent and Ravenna. Southeastward the outer zone follows the Tuscarawas Valley and its associated railroads through the town of Barberton. Thus the southern portion of the extra-periphery is largely industrial in nature, whereas the northeast, except for the war industries of Ravenna, is residential. Like the towns in the Cleveland Metropolitan District these latter likewise possess their own urban individuality.

As the two metropolitan districts have grown in area the outer zones have approached each other by way of the Cuyahoga Valley until at the present time it is rather difficult to discern the separation. Thus the two districts, although strikingly different in many respects, constitute a well-marked urban alignment. Cleveland is the commercial capital, whereas Akron is a specialized member. Because of the nature of the Akron industry, one depending upon raw materials imported from abroad and skilled labor, location anywhere within the heart of a great nation is suitable. The circumstances that developed the rubber industry in Akron are responsible for the addition of this unique note in the urban patterns of the Western Reserve.

MAHONING VALLEY METROPOLITAN DISTRICT

Although dominated by the city of Youngstown, the Mahoning Valley Metropolitan District consists of a riverine alignment of cities and towns lacking the customary zonal arrangement (Figure 2). All are alike, however, in that the making of iron and steel is by far the most important activity. Warren, the most northerly of the group,

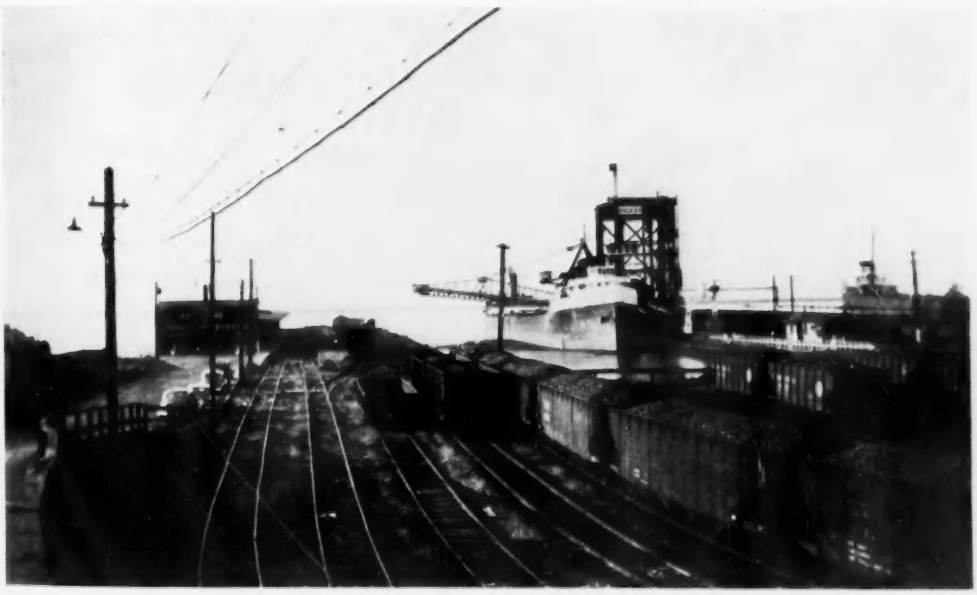


FIGURE 6.—Loading Coal at Dock No. 24, Cleveland. Courtesy of Adelaide Blouch.

lies near the head of the valley where railroads from Cleveland, Fairport, and Ashtabula focus (Figure 3). Youngstown dominates the group and occupies the site where railroads from Conneaut as well as from the Shenango Valley join the Mahoning Valley group. Girard and Niles occupy the narrow valley between Warren and Youngstown, whereas other villages and towns occupy positions beyond Youngstown. In this valley coal from the Appalachian fields meets iron ore from the Upper Great Lakes. The floor of the valley is the site of the heavy industries; thus the unusual condition of heavy industries adjacent to the core of a city. This is true of both Youngstown and Warren. The cores of these cities occupy the highland just above the river valley and the industries the adjacent lowland. Because of the dominance of the manufacturing of iron and steel in the valley foreign populations are large, and the cities are characteristically mill towns. Residential areas, especially those near the industrial sections, are poor. It is only in the outer districts of the cities that better living conditions are found. Youngstown, especially, lacks the residential quality of the extra-periphery so characteristic of the Cleveland Metropolitan District.

Although a portion of the Western Reserve, the Mahoning Valley is definitely inter-regional in character since it is a portion of the much larger Upper Ohio Industrial Region.

STAGE OF URBAN DEVELOPMENT

The three Western Reserve urban districts contrast sharply in pattern, form, and function. The Cleveland Metropolitan District, a regional capital, displays a marked adjustment to the lake plain and adjacent uplands. As such it is asymmetrical in pattern and reflects the focus of land, water, and air routes as a regional capital should. The Akron Metropolitan District on its interior site reflects the development of an urban area dependent upon specialized industry in which bulk transportation and nearness to special markets are not critical factors. This district is representative of the con-

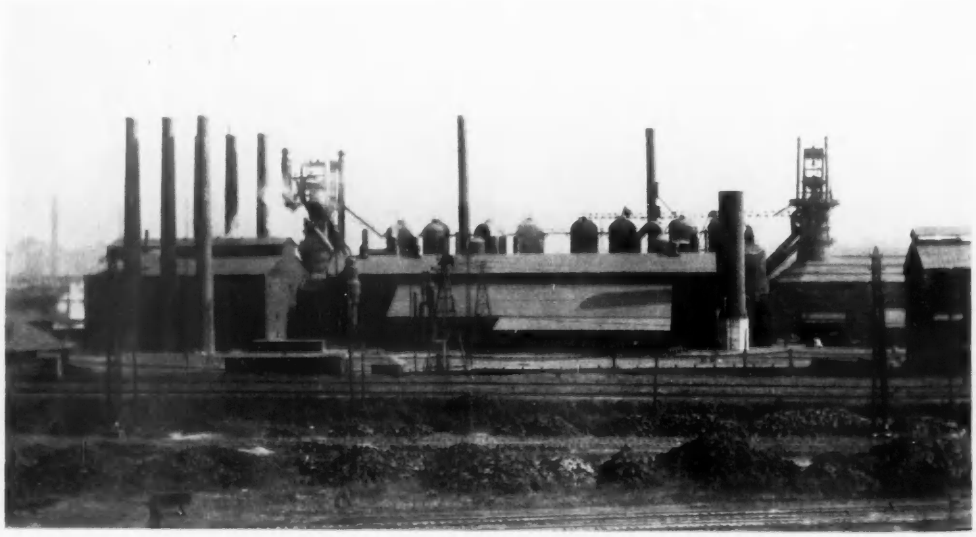


FIGURE 7.—Blast-Furnace of Otis Steel, Cleveland. Flats Industrial Area. Courtesy of Adelaide Blouch.

FIGURE 8.—Coke Ovens—Quenching Tower—Republic Steel Company. Cleveland flats industrial area. Courtesy of Adelaide Blouch.

centrically developed pattern on flat land. The Mahoning Valley Metropolitan District in contrast is attenuated in pattern expressing sharp adjustment to a riverine site in which location in relation to bulky commodities is an outstanding requisite. The Mahoning Valley is likewise a specialized industrial district, in this case heavy industry.

Although exhibiting marked contrasts the three metropolitan districts have several qualities in common. Situation in relation to the commercial and industrial structure of the nation is more important than position within the Western Reserve, for locally produced materials are of minor importance to their commercial and industrial functions. The opportunity of working in industry in each metropolitan district has attracted a foreign-born population, especially from southern, central, and southeastern Europe, which has done much to obliterate the New England origin of each district. It has been the influx of the foreign-born that counted heavily in the expansion of the urban areas to their present stage of development. A well-established group of industries localized in relation to definite natural environmental advantages, a pool of labor both skilled and unskilled, and a nation-wide or even world-wide reputation are characteristics common to all three urban districts. Well-developed commercial activities, especially retail establishments, maximum residential areas in relation to those of other functions, and a wide variety of social organizations, both private and public, are further evidences of the ability of the districts to support the greatest number of people on the highest standard of living. A rising standard of living and a rapidly increasing population are characteristic of a boom town and are indicative of a youthful stage of development. Whereas an urban population increasing at a decreasing rate at the same time maintaining the high living standard which is characteristic of the Western Reserve urban districts, is further indication of urban maturity.

FIGURE 9.—Montana Milling Co., adjacent to the core of Cleveland. Courtesy of Adelaide Blouch.

RURAL OCCUPANCE

Outside of the urban districts the Western Reserve is divided into two parts, the Eastern and Western Rural Districts (Figure 2). The line of demarcation is quite clearly drawn along what has been called the Cleveland-Akron alignment. Thus the eastern portion is associated with the Allegheny Upland and the narrow lacustrine plain, whereas the western portion occupies the Interior Lowland (Figure 10). Although the same township and village pattern with its marked New England origin is characteristic of both districts, sharp contrasts give to each their own individuality. The east grew slowly and steadily to its present development, whereas the west reached its peak about the time of the Civil War and has since declined. The east tends to partake of the qualities of agriculture of eastern United States, whereas the culture of the west resembles that of the Corn Belt. Thus the personalities of the rural districts quite clearly reflect the relationships of their New England culture to the contrasting elements of the natural environment of the Western Reserve.

EASTERN RURAL DISTRICT

Towns and Villages—One of the conspicuous features of the Eastern Rural District is the arrangement of the villages, towns, and cities. Most of the large towns and cities are concentrated on the narrow lacustrine plain in two well-marked alignments; one on the landward side and one on the lake side (Figure 3). The lake-side towns and cities are for the most part lake ports and resorts, whereas the second group are railway towns which are located on the well-graded lacustrine plain. The economic functions of the former group are largely concerned with lake shipping for interior cities, whereas the latter tend to be market towns for the intensified agriculture of the immediate areas.

On the upland there are few large towns or cities, and population tends to be evenly spread. Small villages, the majority of which are unincorporated, are spaced at fairly regular intervals in relation to a pattern of highways which tend to be oriented with the cardinal directions of the compass (Figure 10). These villages function chiefly as rural agricultural market towns, and, since the railroad pattern is not well developed in the eastern upland, the county seats tend to be the only ones assuming prominence. The railroads in this portion are largely north-south lines and are designed to transport iron ore from the several lake ports to the industrial sections of the Mahoning Valley. Several of the villages are served by these routes and therefore have increased a little in importance.

It is in the pattern of these villages that the New England origin is most apparent. The village squares, surrounded by stores and colonial churches, are the conspicuous elements. Although largely agricultural market towns, a few have taken on an extra note in their personality. Maple sugar camps, a small rubber factory, creameries, lumber mills, and a few grist mills add diversity to the market center quality. The Eastern Rural District is definitely

old and presents a stable though not wealthy agricultural economy. Agricultural market towns, unincorporated villages, lake-side towns, and farms dominate the scene. Farms of medium size, many of which are still operated by descendants of the original owners, are mainly concerned with general mixed agriculture in which the feeding of livestock and the producing of dairy products assumes an important place. Hay and fodder are important agricultural crops. Corn is less significant, and small grains, especially wheat, are not outstanding. Although a considerable portion of the area is under cultivation, woodlands, pastures, and meadows are conspicuous. The rolling nature of the upland and the mediocre quality of upland soil give some insight to this type of utilization. Nearness to the several urban districts is also a factor in explaining the importance of the dairy industry. The fact that the Eastern Rural District has never been a wealthy agricultural land, but has grown slowly and maintained its position in a stable manner, is in keeping with its upland environment and its present contact with urban districts.

Agricultural Patterns—Almost three-fourths of the land of the Eastern Rural District is occupied by farms. Farm occupance varies from place to place reaching a maximum of four-fifths in the northeast. The crop combination consists of hay and forage, corn, and small grains. In this respect, together with a wide distribution of small woodland plots, the Eastern Rural District exhibits the general agricultural qualities of the Appalachian Upland.

Acreage in small grains is nowhere very great. In the south, where less than three-quarters of the total area is devoted to farms, small grains are most important, but even there they rarely exceed 13 per cent of the farm area. Over the rest of the district small grains are grown on one-tenth or less of the farm area. Corn lands assume much the same pattern. The northeast is the least important. There corn land amounts to approximately eight per cent of the total farm areas. The south, however, is somewhat more important, but even there corn acreage does not exceed ten per cent. Thus, the Eastern Rural District consists of two parts in so far as the general crops are concerned. The northeast, although more completely utilized by farms, tends to be less completely cropped, whereas the south, occupied to a less extent by farms, has a larger proportion of farm area in crops. Forage and woodland are important in the agricultural economy of the northeast and probably express the true nature of the Eastern Rural District, whereas the south grades imperceptibly into the agriculture of the Western Rural District, which in turn partakes somewhat of Corn Belt qualities.

Tilled Crops—Although the largest proportion of cropped farm land is utilized for corn, the proportion of total area is relatively small. In no place is more than six per cent of the total area so used, the southwest being highest in this respect. Most of the corn in the southeast is harvested for grain, whereas in the north it is utilized for other purposes. Production per acre is higher in the central part of the district than in the rest of the area. There it is more than 40 bushels to the acre. This is due in part to a wide post-glacial valley that has been partially filled with alluvial materials through which now meanders the Grand River (Figure 10). The deep soil and the flat terrain here contrast sharply with the thinner soils of the remainder of the rolling upland.

The total area in wheat, both spring and winter, is somewhat less than corn.

Spring wheat acreage is insignificant in comparison with that of winter wheat. Throughout the entire district winter wheat tends to be spread in about the same fashion as is corn, with about twice as much acreage in wheat in the south as in the north. However, no more than four per cent of the total area is used in this manner. Productivity is not especially high. In the Grand River Valley, where between 15 and 20 bushels per acre are produced, a peak is reached for both spring and winter wheat on the lacustrine plain in the lower course of the river. On the upland, especially to the east, acreage is lowest. Other small grains follow about the same pattern. Approximately five per cent of the area is utilized for oats and about one per cent of the area for rye. Production per acre for both small grains is relatively small, being about 13 bushels per acre for rye and 25 for oats.

A variety of other tilled crops is produced in the Eastern Rural District of which potatoes are most important. It is in the valley of the Grand River where potato cropping is most concentrated. Here about two per cent of the total area is used for potatoes, although in the adjoining northeastern uplands one per cent of the total area is utilized in this fashion. Production is high, averaging better than 150 bushels to the acre over most of the producing area. In the same locality, especially on the lacustrine plain, are greenhouses and nurseries. The lacustrine plain at the mouth of the Grand River is notable for nurseries, whereas farther east on the lacustrine plain, especially in the vicinity of Ashtabula, greenhouses are important.

Hay and Forage—Hay and fodder crops are especially outstanding. Sorghums, legumes, small grains, timothy, clover, alfalfa, and other tame and wild grasses constitute the bulk of this group. Timothy, clover, and sorghums are most outstanding in amount of total area utilized. The three combined occupy in some places more than 13 per cent of the total area. Although fodder

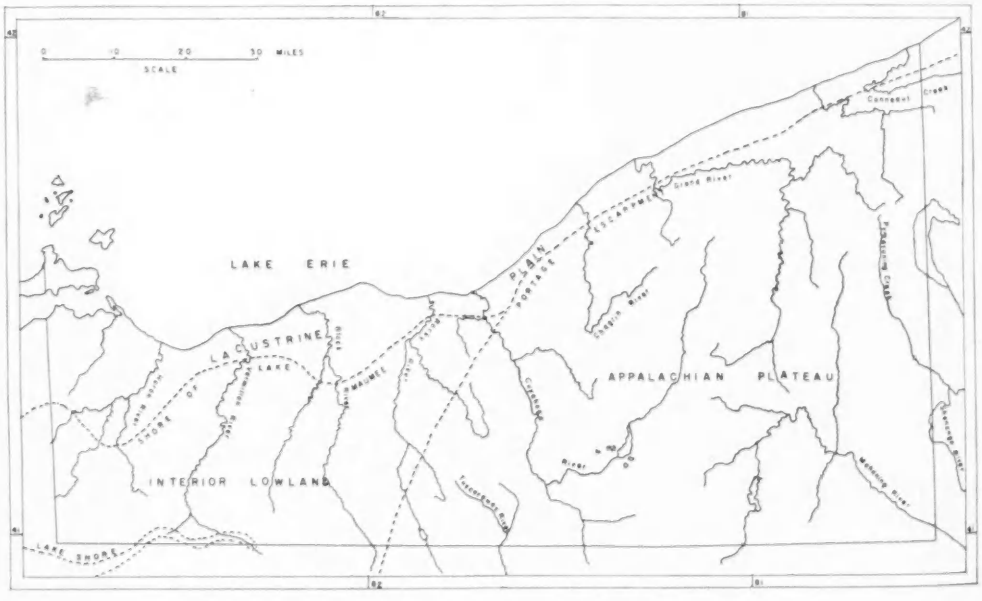


FIGURE 10.—Physiographic Patterns of the Western Reserve.

crops are important everywhere, the extreme northeastern upland is outstanding for all with the exception of alfalfa. Alfalfa, like corn, is more important in the valley of the Grand River, especially in the lower portion of the valley. In production, however, areas differ. Legumes are outstanding in the uplands, whereas clover is important in the lower Grand River Valley. Small grains and sorghums are most productive in the southwest in which most agricultural commodities, especially corn, wheat, and other small grains are important. This section is composed of the valleys of the Grand and Cuyahoga rivers (Figure 10).

Pasture and Woodland—Over most of the district 20 per cent or more of the farm land is occupied by pastures, woodlands, and waste land. This type of utilization reaches a climax of approximately one-third of the farm area in the uplands between the Grand and Chagrin rivers in Geauga County, famous for its maple sugar. Woodlands are most notable on the aforementioned upland lake bluffs, and adjacent plain where they occupy more than 15 per cent of the farm land. There are numerous orchards on the northern edge of the Appalachian Plateau where the Portage Escarpment faces the lake, and at various places on the lacustrine plain below, where air drainage from the upland reinforced by lake influences retards the frost hazards. The mouth of the preglacial Grand Valley as well as its associated lake plain is especially noteworthy in this respect. A second area is associated with the bluffs of the Chagrin Valley and a third with those of the Conneaut. The remainder, however, is not devoid of forests, for more than ten per cent of all farm area is in woodlands. Pastures are second in importance ranging from a high of 21 per cent of the farm land in the valley of the Pimatuning River to a low of eight per cent in the wooded divide between the Chagrin and Grand river valleys (Figure 10).

Livestock and Dairying—In this setting of forage and tilled crops, woodland, and pasture which are associated with the rolling surface of the Appalachian Plateau, livestock raising and dairying have become important. The Eastern Rural District is the dairy section of the Western Reserve, having as its center the upper valleys of the Grand and Chagrin rivers and the associated divide. Here for each acre in crop and pasture there is at least one dairy animal, whereas in the remainder of the district as well as in the rest of the entire Western Reserve the density of dairy animals is considerably lower. The nearness of the district to the several urban centers as well as the comparative disadvantages for tilled crops are outstanding factors of importance to dairying. Other animals, however, are relatively unimportant. This is especially true of hogs and sheep. Since tilled crops are not important, the need for draft animals is not great, and, therefore, mules and horses are of little importance. An exception, however, is the small section of intensive agriculture, especially the nurseries and orchards, on the lacustrine plain and morainic ridges at the mouth of the Grand River. Here draft animals are most numerous.

Thus the Eastern Rural District is an area of dairying in which pasture, woodland, and forage crops are dominant, and corn, small grains, and other tilled crops are of less significance. This personality is the outcome of a slow but steady growth to its present state of maturity. In it are reflected the less desirable qualities of the Appalachian Upland as an agricultural land as well

FIGURE 11.—Congregational Church, Twinsburg, Ohio. Courtesy of Finley Foster.

as the advantages that nearness to urban markets provide.

Rural Industries—A variety of rural industries have developed from the products of agriculture. Saw mills are widely distributed although the largest number are found in the extreme northeast. Seasonal industries based on perishable agricultural commodities and forested products are concentrated in the upland between the Grand and Chagrin valleys. Usable clays are widely scattered, although the greatest concentration of ceramic industries, especially brick making, is found in the southeast near the Mahoning Valley Urban District. Some coal deposits also are worked in the south. Related to the salt deposits on the lake plain at the mouth of the Grand River is a large chemical industry. Thus, a variety of non-agricultural activities gives a note of diversity to the agricultural personality of the stable Eastern Rural District.

WESTERN RURAL DISTRICT

The Western Rural District occupies the till plain of the Interior Lowland. The soil here is deep and more productive than that of the Appalachian Upland, and, largely for this reason, the district reached its maximum development before the Civil War. The agricultural villages, which are here spaced regularly at five-mile intervals, are characteristically New England in pattern but now have smaller populations than they had 80 years ago. A few railroad towns in which industries have developed have increased in population. The wood-working industry of Norwalk, the railroad machine shops of Willard, the machine shop industries of New London and Wellington, and the trucking interests of Monroeville are examples of this type (Figure 2). Sandusky is the only city of over 10,000 population. Its significance is due, in part, to its position on Sandusky Bay where roads and railroads from all directions meet the lake.

As in the Eastern Rural District corn, small grains, and hay dominate the agricultural landscape although production per acre and the proportion of land in crops is considerably higher. Livestock, especially hogs and sheep, are more important, whereas dairying is less so. Secondary agriculture, such as truck farms and vineyards, is also important on limited sites, notably the beach ridges and the peninsula of Marblehead.

Fishing villages and summer resorts line the lake front. Sandstone is quarried in the vicinity of Amherst, and limestone from Marblehead is shipped to the cement factories across the bay and to the steel industries farther east. The Marblehead peninsula is dotted with orchards and vineyards, and there are wineries and distilleries in the Sandusky district.

Over the flat lands of the till plain a series of short streams pursue parallel courses to Lake Erie. The Huron,

Vermilion, and Black rivers are the three most important ones (Figure 10). Their lower courses cross the level surface of the lacustrine plain interrupted only by low sandy beach ridges. The upper courses drain the undulating surface of the till plain. Upon these two types of land have been developed the several agricultural economies. The early importance of agriculture to this district is indicated by the place once held by wheat. The village of Milan on the Huron River a few miles north of Norwalk (Figure 2) in pre-railroad days was an outstanding shipping center for wheat, which was stored in great warehouses and shipped by boat down the Huron River to Lake Erie and thence to more eastern markets. The development of railroads and highways as well as the opening of richer agricultural land to the west has checked the importance of agriculture and helped to change the personality of this portion of the Western Reserve.

Tilled Crops—The southwest corner, chiefly on the Interior Lowland, is most important agriculturally. It is here that farms are largest, owner operators fewest, and the acreage of harvested crops largest. The two leading crops, corn and wheat, reach their greatest importance here. Other small grains, especially oats, barley, and rye, are minor. Rye is of greater importance on the rougher land farther east, especially on the rolling lands where the Appalachian Plateau meets the Interior Lowland. Oats, since they are produced for animal feed, conform to the general agricultural pattern.

Hay and Forage—Timothy and clover are the most important hay crops. In the southwest over ten per cent of the total area is used for a combination of these two. Alfalfa and sorghums are the next most important forage crops, although they are minor since less than one per cent of the total area is devoted to either. On the lacustrine plain south of Sandusky other forage crops such as sweet clover and tame and wild grasses are important. Small grains cut for forage, however, are distributed much the same as alfalfa, timothy, and clover and therefore are most important in the better lands of the Interior Lowland.

Pasture and Woodland—Pasture is relatively unimportant in the Western Rural District. The area of greatest importance in which over 18 per cent of the farm land is so used is found on the Interior Lowland between the Vermilion and Black rivers. This area, however, is not as significant as the pasture lands of the Eastern Rural District. Pasture in rotation, since this is a till crop district, is much more significant. Woodlands, although not lacking, are least important of all general types of utilization. The only section in which the percentage of farm land in woodland reaches as much as 15 per cent is a small area in the south at the headwaters of the Black and Vermilion rivers. The lacustrine plain is least important since only five to ten per cent of the farm land is wooded.

Livestock and Dairying—To the general pattern of till crops, forage, and pasture is related the pattern of livestock raising. Cattle raising and dairying are relatively minor over the entire district, whereas hogs and sheep are outstanding. The ratio of hogs to crop and pasture land is one animal to 15 acres, whereas one animal to ten acres is true of sheep and lambs. Although hogs are most numerous in the west, both on the lacustrine plain and the Interior Lowland, sheep are more than twice as numerous on the Interior Lowland as they are on the lacustrine plain. Since the Western Rural District, especially the southern part, is a land of general

mixed agriculture in which till crops are important, horses and mules are most outstanding here since they are used for draft purposes.

Special Crops—Two types of special crops, fruits and vegetables, are characteristic of the Western Rural District. The orchards and vineyards are concentrated on the peninsula of Marblehead and nearby Bass Island and a small section of the lacustrine plain adjacent to Sandusky Bay where frost protection is afforded both by air drainage and the warming effects of Lake Erie. On the rolling edge of the Interior Lowland and the beach ridges of the lacustrine plain between the Black and Vermilion rivers is another orchard and vineyard district. Greenhouses are likewise concentrated in the same section on the beach ridges of the lacustrine plain and the northern edge of the Interior Lowland. The city of Elyria is approximately centered in the greenhouse vegetable district. Potatoes are an important agricultural crop on the lacustrine plain and on the poorer lands farther east. The marsh lands of the lake embayment on the southern edge of the district are important in a few spots for market produce.

AGRICULTURAL CONTRASTS

The Western Rural District surpasses the Eastern in most functions. No place in the Eastern Rural District, except in the Grand River Valley, does the amount of land in farms approach that of the Western. Farms occupy more than 80 per cent of the total area of the Western Rural District and in a few places reach as much as 90 per cent. The size of farms also is larger here for farms of over 100 acres are the rule as compared with those between 70 to 80 acres in the Eastern Rural District. In one respect, however, the latter dominates and that is in owner-operated farms. A much higher proportion of tenants live upon the farms of the Western Rural District. This is in part due to the fact that the land, being more productive, had a ready market and therefore has changed hands more often. Absentee ownership has therefore developed. Again since the area is largely the rolling terrain of the Interior Lowland a larger proportion of the total area is arable. As much as 65 per cent of the total area is available for crops, whereas no place in the east is as high as 50 per cent. Farm lands in harvested crops are likewise greatest in the west. As much as 60 per cent is used for harvested crops, whereas about 40 per cent is the best in the east.

FIGURE 12.—Chagrin Falls, Ohio. Courtesy of Finley Foster.

Corn, small grains, and hay dominate the agricultural economy as they do in the east. However, about twice as much area is utilized for corn. There is little difference in the productivity of the two agricultural sections. In both, bushels per acre are between 35 and 40. Wheat is second in importance to corn. In the Western Rural District wheat and corn are about equal in the proportion of land utilized, whereas in the Eastern Rural District about twice as much area is used for corn as for wheat. The spring and winter proportions are approximately the same in both districts, with a slight increase in

spring wheat in the western part of the Western Rural District. In productivity, however, both spring and winter wheat varieties are outstanding in two sections. Whereas approximately 15 bushels per acre is the average production for the Western Reserve, the lacustrine plain of the Sandusky area and the mouth of the Grand River are the two areas where production is between 20 and 25 bushels per acre.

FIGURE 13.—The Bronson House, Peninsula, Ohio. Courtesy of Finley Foster.

STAGE AND RURAL DEVELOPMENT

Through the entire rural area of the Western Reserve runs a note of solidarity, of completeness of utilization without congestion, of comfortable rural living. The well-built old New England farm houses and the regularly spaced villages together with their Anglo-Saxon names on most of the mail boxes—names of the original owners—contribute directly to this quality. Long ago the population ceased to show signs of rapid increase, for the rural economies have long since reached a point where they are supporting a capacity population on the highest living standards. The original New England impression remains, with minor alterations of modern technology. Stable maturity characterizes the rural districts of the Western Reserve.

AREAL MATURITY AND GEOGRAPHIC STABILITY

The Western Reserve, a region in the sense that obsolete political boundaries give it areal delimitations and the cultural forms and patterns of an early occupance help to color its personality, clearly presents evidences of maturity. The ratio of population to the sum total of natural environmental resources, the general standard of living, and the qualities of stability are the basic criteria of its present state of geographic development. The urban districts, stimulated by industrial development several decades ago, increased rapidly but have since leveled off to a slow but steady increase measured in terms of the general ability of the districts to support those people. World War I did much to accelerate the urban districts. The rural sections display the same balance in a different manner. The Eastern Rural District in relation to the poorer lands of the Appalachian Upland has experienced a slow but steady increase of population throughout its entire existence, whereas the Western Rural District grew rapidly as the better lands of the Interior Lowlands were brought under production. Competition with better lands farther west caused an actual decrease until a final mature balance of people and supporting natural environmental resources was reached.

The ability of maintaining the highest standard of living commensurate with the sum total advantages and disadvantages of the area is a second significant quality of maturity. The urban districts as well as the rural display this quality. True, they are not all equal in wealthy living; each displays a general level of living in keeping with the balance of advantages and disadvantages attendant upon the conditions of site and situation of each area. In the rural districts the proportion of tenant operated farms is indicative of an agricultural land rich enough to support tenants and absentee owners.

To the general observer the condition of the farmsteads, the fences, the crops in the field, the quality of the livestock, the highways, and the little commercial villages are evidences of comfortable, profitable rural living. Tenant-operated farms are much more numerous in the Western Rural District, a fact which adds evidence in favor of a slightly higher standard of rural living in that district. As has been already pointed out each of the three metropolitan districts presents a distinctive personality, no small part of which is evidenced by the standard of urban living maintained in each. Thus it appears that maturity from a geographic sense is that stage in areal development in which the greatest number of people is supported on the highest standard of living. In other words, a climax development has been reached. The endurance of that climax, the permanency of that maturity, however, depends largely upon a quality that may be expressed as stability—the ability to return to a functioning state of maturity when forces disrupting the economies upon which that maturity is based are removed. This quality in the final analysis goes back to the very fundamentals of the geographic concept—the wisdom with which the human elements have utilized the natural environmental resources, singly and collectively, to further their cultural pursuits. Obviously, unwise utilization, although it may produce high living standards immediately, is an instable condition, and will eventually lead to permanent decline. A good measure of stability is the ratio of the total weight of tenable economic, social, and political adjustment to natural environmental resources over maladjustments. The weighing and evaluating of the utilization of natural environmental resources is no simple task. The personality of each district, however, seems to substantiate the qualities of stability and justify the characterization of the Western Reserve as an area of stable geographic maturity.

World War II has released the forces that will test the stable qualities of the structure of the area. The nature of the industries of the three urban districts is such that the disruptive forces fall directly on them. To say that iron and steel, rubber, and machine tool industries have increased so rapidly that they have placed a heavy drain on the immediate labor supply is a mild understatement. The unprecedented increase in industry, especially in the production of war goods, is causing a profound change in the entire geographic structure. Rapid plant expansion is most characteristic. In the rural as well as in the urban districts new factories have sprung up and old ones have enlarged in record time. In each metropolitan district as well as in numerous towns and villages of the rural districts private industries are enlarging and are being taken over wholly for war work. The arsenal north of Ravenna and the ordnance plant south of Sandusky are government activities. War goods dominate the industrial economy.

In response to the rapid change in industry several other sharp disruptive forces have set in. The need for labor of all types and the attraction of high wages have drawn people from other activities and areas to the industrial sections of the cities. This tendency, along with the selection of men for military service, has put a heavy drain on the structure of the rural districts. Since the newcomers are not only from the rural districts of the Western Reserve but from areas as far away as West Virginia and Kentucky, an even greater strain has been placed upon the urban districts. The lack of adequate

housing was the first evidence of the disruption. Trailer camps, housing projects, and the control of rents by the declaration of defense housing areas were direct results. Further evidences of disruptive forces are the crowding of public schools in the defense plant districts, the rising cost and scarcity of consumers' goods, and the rationing program. The rationing of gasoline is especially significant in those outlying residential districts depending almost entirely upon private automobiles for transportation. The Cleveland Metropolitan District with its extensive residential areas scattered far and wide beyond the limits of public transportation feels the effect of transportation curtailment very keenly.

In the rural districts the disruptive forces have been felt in a different manner. Except in the areas where war plants have been introduced, the problem of too few, rather than too many people has been the pressing one. Available labor has been greatly reduced both by the armed forces and by industries. Agricultural production, especially in certain commodities, has fallen due to insufficient labor at critical times. Orchards, vineyards, truck and market gardens, and greenhouses have had to curtail their production in part due to the lack of sufficient labor at harvest time. Dairying also has been affected by the labor shortage. The size of dairy herds is decreasing by the sale of animals due to insufficient help to care for the number of animals characteristically supported by the Eastern Rural District. The county commissioners of agriculture are attempting to meet this problem by advising the careful planning and budgeting of the time of available farm labor throughout the year. Curtailment of agricultural production is reflected in both rural and urban districts. Although the depleted stocks of food reflect the war trends of the entire nation, a curtailment of milk is a local problem since most of the dairy products of the urban districts come directly from the Eastern Rural District. In the rural districts seasonal industries, especially those based upon perishable fruits and vegetables suffer from a depleted source of supply.

Thus in innumerable ways World War II is disrupting the economies of the Western Reserve as well as those of all the rest of the nation, in fact, of the world. If the mature stage of geographic development was one of stability, as ample evidence seems to indicate it was, at the beginning of the war, it would be logical to expect it to return to the same stage after a victorious termination of the war. It need not follow that identical activities will be pursued in the same manner as before, but that the sum total of economies in relation to the composite advantages and disadvantages of natural environmental resources will be such that the greatest number of people will continue to live on the highest standard of living in the Western Reserve.

EDITORIAL

POST-WAR GEOGRAPHY

Sidman P. Poole, Lieutenant Colonel, U.S.A.

IT is part of the American way of life that the individual initiative and intelligence of our people should be fully utilized to solve their own problems. There will be a great challenge to all interested in geography and its place in school and college curricula when this war is over. The utmost intelligence and initiative of American geographers will be necessary to meet the crisis in American education. Such compelling challenge should arouse their determination and their resolve that in all the decades to come the study of "the earth as the home of man" shall be accorded the great importance that is its due.

World War II, with its planet-wide battlefields, its emphasis on "global strategy," its unprecedented use of maps, and above all, perhaps, the growth of air mindedness of all the armed services, has turned the attention of the public to world geography as all articles, papers, and appeals of all geographers in the world could not possibly have done. Geographic training as a real war asset has been recognized. Can, and will, geographers see to it that this great interest and appreciation are not lost? Will they collectively, the nation over, guarantee that real and scientific programs of geography teaching are imbedded in the curricula of every school in the country down to primary grades and up to and including senior classes in the high schools? Will universities and colleges accept the challenge and perform their part? (One might almost say their duty.) Their part must of necessity be the training of teachers properly grounded in the basic principles of one of the most difficult of disciplines—this of earth-man relationships. For it must be recognized that geographic concepts, and even mere content of geographic knowledge, can only be attained by long and intensive study analogous to that pursued by the geologist or the historian. Geographers must insist that ill-prepared teachers be replaced by others thoroughly trained, with at least an A.B. in the science.

The war has definitely shown the need for more and for better trained geographers. Even before Pearl Harbor, the General Staff were calling in officers who had had geographic training. At the present time over a score of officers or civilians are engaged on geographic intelligence in the War Department and the available supply is practically exhausted; for the Army Map Service, the Air Corps, and the Navy have all dipped into the dwindling reservoir of geographers until it has been depleted. Especially is this true since the civilian branches of the government, having equal need of geographers, have likewise drawn from the same shrinking source. Among the agencies that have recognized and called for more and more men and women with specialized geographic training, have been the Department of State, the United States Board of Geographic Names, the Office of Economic Warfare, and particularly the Office of Strategic Services. At a conservative estimate, half the professional geographers of the country are either now permanently in government service or are periodically called in for temporary duty. The truth is

undeniable, that our colleges and universities had not produced nearly enough geographers to satisfy the demands of this national crisis.

Geographers have been needed who are skilled in physical geography and in cartography. They have been of especial value if they had previously done extensive field work in foreign theatres of operation. It has been astonishing, for example, to discover how few of our geographers had any first hand acquaintance with Africa, —or even with Europe for that matter. Foreign travel and study should certainly be more emphasized in the future. Lack of such trained personnel is the number one problem for the profession to face. Just as we should never again be caught napping with an inadequate army and navy, so should we never again be caught with an inadequate supply of professional geographers so vitally needed in national emergencies.

The drain into government service has, of course, sadly depleted the teaching staffs of our universities and the cream of trained personnel in the secondary schools has been drafted. Right now it is ludicrous, and yet tragic, that the actual bulk of geographic teaching on the university level is being done by devoted men and women who last year were historians, or geologists, botanists, or accountants. Make-shift intensive six week courses can never replace the sound, scholarly programs of study that lead to the M.A. or Ph.D. in geography.

This is problem number two—the provision of a wide and deep reserve of trained geography teachers in our secondary schools who can fill the places of those who leave academic halls when war calls them; and properly trained teachers who can properly teach geography in those schools must come out of our universities.

It is trite to call attention to the fact that aerial warfare is changing our concepts of the world almost overnight. As a people, we are groping towards "three dimensional" thinking at a more rapid rate than ever before;—witness the flood of maps and of the striking new projections appearing in the magazines that reach the millions. They are finally revealing the defects of the antiquated Mercator which has for so long misled so many of us.

When this war is over there will have been built airfields on the lava plains of Iceland, the desert sands of Africa, and along the wooded shores of South America, and there will be thousands of trained pilots and scores of airplane factories. These installations and these skilled men must be made use of in the post war world. Other thousands of American boys who will have seen the bazaars of Egypt, the seaports of Africa, the castles of Europe, the ricefields of the Orient, and the coral islands of the Pacific, will be aware as never before, of trade possibilities. Trade in refrigerators, in fountain pens, in chewing gum, and the thousand and one other "gadgets of Americanism." Great industries will make use of all such potentialities; in fact, plans for just this are being floated daily. Wide national economic and industrial interests of the future impel geographers to prepare to do their bit to meet these needs.

This is problem number three—to meet the demands of peace. And its solution can lie only in far reaching curricula changes reaching right down to the first grade and in a teacher training program to supply the necessary teachers for such curricula. In our Area-Language set up for war training we have, in embryo, a concept that perhaps can be well extended to all the schools of America. Earth-man relationships may well be made the core of all teaching—just as too often it has been language or history alone.

These are some of the challenges that strike him who is aware from the inside of our lack of professional geographers, of trained teachers, and of a general public inadequately oriented in geographical concepts.

For the reasons already stated, for the highest patriotic motives of national welfare, and from the more selfish desire to widen our own influence, geographers should prepare to meet these challenges. The initiative and intelligence of geographers should lay the foundations for the future of American geography. It should be national in scope and epochal in time. It should be practical in its ends and scientific in its means. And the foundation stones should be laid right now.

BOOK REVIEWS

COULTER, JOHN WESLEY. *Fiji, Little India of the Pacific.* The University of Chicago Press, Illinois. Price $2.00.

When this war is over Americans will, or at least should, be much better acquainted with the islands and countries and peoples of the Pacific than they have ever been before. Hundreds of thousands of their soldiers and sailors and marines and air men will come back from that part of the world, and that great sector of bitter fighting, with a first-hand acquaintance of the antipodes and their equatorial environs, so direct and so explicit that they will stimulate more study and research about those regions than there has ever been before. Hitherto Americans have been very little concerned with that vast section of the world's surface, with its luxuriant vegetation, its teeming animal life, its dense and primitive populations, its varied and abundant resources. They have been quite content to leave to other peoples of the world the exploration and development of those prolific lands. Now a large part of the American population will be intimately acquainted with all of these interesting things, and quite alive to the economic and strategic possibilities of the area.

The author of "Fiji, Little India of the Pacific," John Wesley Coulter, has been for many years professor of geography in the University of Hawaii. He has traveled widely over the South Pacific. He has made the region one of his principal subjects for research. He is thoroughly acquainted with the literature on the region, and with many of its peoples, their customs, and their character. At present he is an officer of relatively high rank in the armed services of our country, and one of the men upon whom our general staff depends for first-hand information of the region, and advice on the problems of military action that confront our American forces there. He is a careful, industrious and trustworthy research worker, whose articles and reports bear the stamp of authority and accuracy.

"Fiji, Little India of the Pacific" bears the impress of the careful field work that its author has done in the area with which this book is concerned. The treatment he gives to his subject is thoroughly scientific in its plan and organization; it is thoroughly geographic in its technique and discipline. Though the book is only 150 pages in length it affords a clear and exact picture of conditions in the Fijis. Every aspect of the country and the lives of its people are set forth in clear, effective English. The arrangement of the material is orthodox and conventional, beginning with the natural setting and the population, and ending with a forecast of the future; but it is far from trite or uninteresting. Every chapter is compact and to the point, leaving little of importance untouched, yet excluding discreetly a mass of detail that might obscure the more salient facts. The author shows his restraint, as well as his training in science, in the very eclectic choice that he has made of the material that he includes. The book will undoubtedly take its place in geographic literature as an authoritative source for sound geography of the Fijis.

Labor Relations in the Pulp and Paper Industry of the Pacific Northwest. Published by the Northwest Regional Council, Portland, Oregon. Price $2.00.

"Labor Relations in the Pulp and Paper Industry of the Pacific Northwest" is one of the latest and most valuable publications resulting from the work of the Northwest Regional Council, of which John B. Appleton, a trained and experienced geographer, is director. In the last five years a considerable number of important reports and other publications have come from that Council. This is the second in a series of studies sponsored and published under its direction.

Though the study is not distinctively geographic, it has many geographic implications that are of primary interest to applied geography. The director states that "This particular industry was selected for study because it has not experienced a single strike or lockout since the workers were organized and collective bargaining was instituted. The book presents an unbiased analysis and evaluation of the various factors which have contributed to this stability of labor relations. Following a discussion of the economic and institutional framework within which collective bargaining has developed, the actual methods of operation of the collective bargaining machinery and of the accomplishments of this employer-employee system are presented in some detail. The study shows what can be accomplished when 'good faith' characterizes the relations of both employers and the unions in their mutual dealings."

Such studies as these would be valuable for every part of the country, and it is quite likely that as agencies are set up for further planning and activity in various parts of the country, reports will appear in due time, just as significant and just as useful in many other sections. The Northwest Regional Council is to be congratulated upon its leadership in this work.

W. E. E.

WICKIZER, V. C. *The World Coffee Economy.* Food Research Institute, Stanford University, Stanford University, California.

Only from the viewpoint of economic geography does this book have much significance to the geographer, or deserve a very important place on the shelves of the geographical library. It is dominantly economic in its point of view and in its organization and presentation. The first four chapters contain considerable material that is more or less directly related to the geography of coffee as a commodity, but the larger part of the book, by far, is devoted to the economics of the production, supply price control schemes, government regulation and

other equally economic phases of coffee and the world industry that arises from it.

The fact that the book has very little geographic significance, does not detract from its value for economists, for the coffee trade, or for agencies and governments concerned with orderly production processing, marketing and storing of coffee. To these groups the book should prove very valuable because of the exhaustive and detail treatment that it gives to every economic and political phase of the coffee industry. Coffee has long been an important element in world trade and international relations, and will probably remain so for a long time to come. It is one of those commodities about which considerable has already been written in several authoritative and inclusive books, including an excellent treatise of the geography of coffee by Dr. Olof Jonasson of the University of Gothenburg, yet about which there is still a great deal to be said. This book forms a valuable contribution to the available literature on the subject.

An interesting and worth-while feature of the book is the map of World Coffee Production and trade at the front and back, based on the average production for the seasons from 1934 to 1939 and the exports from 1934 to 1938.

W. E. E.

SMITH, H. T. U. *Aerial Photographs.* D. Appleton-Century Company, New York, London.

The increasing interest in aerial photography and in photogrammetry has resulted in the publication of a large number of books dealing with these subjects and with mapping in general. This book "Aerial Photographs" is one of the most ambitious thus far published, and one of the most inclusive of material, technique, and interpretating significance that has yet come from the press. Almost every phase of the subject it covers is dealt with exhaustively, thoroughly, and in every wise, effectively.

Obviously, the geographer will become increasingly dependent upon aerial photography for mapping his field material, and consequently he must become acquainted as fully as possible with the technique that it involves, and the possibilities of using it in his interpretating summaries of geographic distribution.

The book is well printed in clear type on excellent paper, is well bound, and is fully, though not lavishly, illustrated. It should lend itself well to use as a textbook for courses in this branch of cartography and geography, and certainly will find a place on almost every geographer's shelf as a valuable reference book.

W. E. E.

ZIPF, GEORGE KINGSLEY. *National Unity and Disunity.* Principia Press, Inc., Bloomington, Indiana, 1941.

"National Unity and Disunity" is not an easy book for a geographer to evaluate, not only because it is not geographic in its approach and its treatment, but also because it deals with subjects in which the geographer lacks the discipline and technique for adequate appreciation of the thoroughness or the soundness of the treatment. Yet it contains throughout its chapters significant material for the consideration of the geographer in his interpretation of his many phases of human and cultural geography. The purpose of the book is stated at the beginning of Chapter I to b to investigate "(1) the organized behavior of the individual in reference to the social group of which he is a member, and (2) the organized behavior of the social group in reference to the individuals who constitute it."

There is much in the book of interest and value to the geographer. There are many ideas and concepts that are provocative of thought, and stimulating in the way of further investigation. The student of the several fields of human geography, particularly of cultural geography, and to a lesser degree, of social and political geography, may not be able to apply a great deal of the material of the book to his body of knowledge or his philosophy, but there is no question that some of the substance of the book opens up new vistas of geographic relationships and geographic interpretation.

W. E. E.